Technological innovation and local authorities: a case-study of the Greater London Council (GLC)

Thesis

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TECHNOLOGICAL INNOVATION AND LOCAL AUTHORITIES: A CASE-STUDY OF THE GREATER LONDON COUNCIL (GLC).

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ABSTRACT.

The research presented in the thesis is a case-study of a 'socially-directed' technology policy, formulated and implemented by the Greater London Council (GLC) whilst in office, between 1981 and 1986. The GLC attempted to make a direct link between technological innovation and social needs by creating the facilities, in the form of five 'Technology Networks', for user involvement in socially-useful product design and development.

The research is important for an exploration of technology issues. First, it represents an attempt to influence the politics of technological development. Second, it addresses issues of the content of technology and the social organisation of the innovation process.

The Technology Networks comprised the focal points of the research. The objectives were the identification of the factors, both locally and nationally, which affected the policy implementation process. For the GLC, the national economic and political context proved crucial to policy developments: it resulted in their abolition in 1986. The Technology Networks remained in operation, but were increasingly plagued by funding difficulties.

Findings from the study suggest that the access of a different range of social groups of users and producers to the early stages of the innovation process, may be a valuable exercise in itself, but is problematic as a base for an alternative technology policy. Other major constraints on the development of socially-useful technologies are manufacturing and market opportunities.

The conclusions are concerned to explore the potential of a local authority as an agent of technological change, in terms of their role in design and technology education and the creation of an alternative technological hegemony.

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CHAPTER FOUR: THE METHODOLOGY

CHAPTER FIVE: THE GLC INDUSTRY AND EMPLOYMENT INITIATIVE.

CHAPTER SIX: THE TECHNOLOGY NETWORKS.

CHAPTER SEVEN: CASE-STUDIES-ANALYSIS OF FINDINGS.

List of Publications relevant to the Thesis:

Elliott,D. and Mole,V. (1985), 'Technology for People', Design Studies, Vol.6, No.1, January.

Bruce,M. and Mole, V. (1987), 'Towards a Sociology of Technology', Paper to the British Sociological Association Annual Conference: Science, Technology and Society, Leeds, April.

Mole,V. and Elliott,D. (1987), Enterprising Innovation: An Alternative Approach, London: Frances Pinter Publishers Ltd.

Mole,V. and Bruce, M. (1987), 'Case-study of Public Sector Marketing', Cranfield Management School: Case Clearing House.

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LIST OF FIGURES.

LIST OF ABBREVIATIONS.

AUEW Associated Union of Engineering workers.

BTG British Technology Group.

CAD Computer Aided Design.

CAITS Centre for Alternative Industrial and Technological Systems.

CAM Computer Aided Manufacture.

CCD Community Construction Design.

DoI Department of Industry.

ECSC Energy Conservation and Solar Centre.

ERR Earth Resource Research.

GLC Greater London Council.

GLEB Greater London Enterprise Board.

IT Information Technology.

ITDG Intermediate Technology Development Group.

LEEN London Energy and Employment Network.

LIN London Innovation Network.

LIS London Industrial Strategy.

LNTN London New Technology Network.

MAP Microelectronics Applications Project.

MoD Ministry of Defence.

NATTA Network for Alternative Technology and Technology Assessment.

NEDO National Economic Development Office.

NIESR National Institute of Economic and Social Research.

OECD Organisation for Economic Co-operation and Development.

PEDNEL Product and Employment Development Agency for North and East London.

R and D Research and Development.

SCEPTRE Sheffield Centre for Product Development and Technological Resources.

SERA Socialist Environment Resources Association.

SPRU Science Policy Research Unit.

UDAP Unit for the Development of Alternative Products.

WMCC West Midland County Council.

WMEB West Midland Enterprise Board.

INTRODUCTION

There are startling contradictions between what technology could provide and what technology actually does provide. Mike Cooley, a leading member of the Lucas Shop Stewards' Combine Committee and latterly, the Director of the Technology Division of the Greater London Enterprise Board (GLEB), put this most succinctly, when he wrote:

> '... we have a level of technological sophistication such that we can design and produce Concorde, yet in the same society we cannot provide enough heating systems to protect old-age pensioners from hypothermia' (Cooley 1985 p.19).

This is one example among many others. It highlights the uneven relationship between technology and social and political processes.

Technological innovation plays a key role in the process of social and political change. Research on the relationship between technology and society has included social critiques of the impacts of technological change both on society and the natural environment. More detailed analyses have been made of its impacts on the labour process, work organisation and gender divisions. Political analyses of the relationship between power and technology have focused on such technological issues as the nuclear power industry and the social control of technology (Elliott and Elliott 1976, Collingridge 1980). All of this work contributes to an understanding of the social, political and economic causes and implications of technological change. It draws attention to its direct relationship to the way that society works and the forms of social change that are envisaged for it. One example is the association of information technology (IT) with the creation of a post-industrial or knowledge-based society (Bell 1974).

The plethora of literature in the field of technology studies has served to explode certain myths. The notion that technological change equals material progress, and the proposition that technological development is autonomous and unilinear and somehow outside of societal control. At the same time, technology studies have focused on the risks involved in certain forms of technological development. Mesthene sums up the role of technology in the following statement: 'It has both positive and negative effects, and it usually has the two at the same time and in virtue of each other' (1970 p.26).

A key question which emerges from debates on the relationship between technology and society is why we have the technologies that we do or why certain technologies are developed whilst others are not. Attention to this problem requires an analysis of the societal factors that influence the direction of technological development, and an analysis of the technology itself.

The research presented in this thesis is a case-study of an attempt by a local authority to influence the direction of technological change with the formulation and implementation of an 'alternative' technology policy based on social need and the participation of users and producers in the product design and development process. The research is significant as an exploration of technology issues for two reasons. First, the attempt by the Greater London Council (GLC) to influence the rate and direction of technological change was a practical attempt to directly address the politics of technological development. Second, the participation of producers and users in the product design and development process was an attempt to address the nature of the technology itself. The analysis of an attempt to address the nature of technology is in contrast to many theoretical studies of technological change that tend to take the technology as given and treat it as a black-box (Rosenberg 1982). This implies a technological determinist perspective whereby the technology itself is neutral; it is then only the application, use and impacts that are the important considerations to address. The notable exceptions to this are discussed in Chapter Two.

The reason for the choice of this research project was as a follow-up to research already completed by the Technology Policy Group at The Open University on the Lucas Plan (see Wainwright and Elliott 1982). Some of the key personnel at Lucas Industries involved in the Alternative Plan moved to the GLC when the Labour group took control of the council following the 1981 local government elections.

The aims of the research were:

1) to explore how a local authority, the GLC, attempted to develop a programme for the design and development of socially-useful products.

2) to identify the factors, both locally and nationally, that affected the formulation and implementation of the 'alternative' technology policy.

3) to locate a micro or localised study of technological change in a more abstract theoretical framework of innovation studies.

The research is in the form of a case-study of the GLC technology policy. As such it focuses on observable events in a particular setting. The research findings are locally-based and suggest certain factors that need to be taken into account for the implementation of an 'alternative' technology policy. However, the research project attempts more than the illumination of local authority practices on technology policy. The situation of the findings in relation to the more abstact concepts of innovation and the 'social shaping of technology' (MacKenzie and Wajcman 1985) increases their significance. It is considered legitimate to locate the findings of this one case-study and discuss it in terms of macro-level concepts. For example, there is a direct relation between local authority technology policy and questions of innovation and power - not the least in the most effective exercise of power, the prevention of the very existence of alternatives (Lukes 1974, MacKenzie 1987).

The theoretical part of the project is presented in Chapters One and Two.

Chapter One looks at the innovation process and places it in the context of a capitalist market economy. The analysis of technological innovation from an economic perspective rests on a purposive study of innovation and its relation to competitiveness; technology is defined as innovation in terms of the 'knowledge of techniques' that enhance competitive performance. This view presents a picture of the design and development of products that is closely tied to notions of commercial success, market share and profitability. A discussion of technology and social needs locates innovation at the centre of social life. It is important to take this approach to innovation because much of the literature treats technological change in an abstract way and in so doing removes technology from the very real problems associated with technological change.

Chapter Two discusses the social and political influences that are embedded in technological artefacts. The identification of the social processes that affect technological design and development highlights possible points of intervention for the practical implementation of a technology policy. The idea of socially useful production attempts to make closer links between designers and users and perceived social need. These ideas are rather slippery, for example, products can be found to be socially useful because they sell on the market, people would not buy them otherwise. Social-use, when applied to the GLC approach, refers to products and processes aimed at the public sector provision of goods and services. To this end the GLC created the facilities, in the form of the 'technology networks', for producers and users to participate in the product design/development process.

However the design and development of products does not occur in a vacuum. The factors which closely affect the innovation process are explored in relation to the GLC initiative. Chapter Three sets the case-study in the national economic and political context. It draws attention to the hostile political climate nationally (for example, the tension and conflict between the Conservative government and the Labour-controlled GLC), and the limitations on resources for a local authority attempting a policy initiative of this nature.

Once the setting for the case-study has been described, the next task is the explanation of the research method. The methodological approach; the case-study, for the research is discussed in Chapter Four. The case-study as a research method allowed a flexibility to collect data from a variety of sources, and was deemed the most appropriate method for the study of a policy initiative that was unfolding at the time of the research; between October 1982 and March 1986 when the GLC was abolished.

Chapter Five sets the GLC policy in the context of its own political structure and identifies the historical strands of thought that influenced the 'alternative' policy formation. The main points of the GLC Industry and Employment policy are described. Local socialism, the Labour Party Programme of 1973, workers' plans, community/popular planning and the notion of pre-figurative politics are discussed in an effort to demonstrate the historical continuity and diversity of the ideas which fed the GLC practical experiment.

Chapter Six presents the findings of the case-study research on the technology networks. It looks at how the ideas on which the 'alternative' technology policy was based, worked out in practice.

Chapter Seven offers a locally based analysis of the research findings. For the development of alternative technologies the problems and constraints of manufacture and markets need to be addressed: this is both an economic and a political problem. The access of a different range of social groups of users and producers to the early stages of the innovation process can affect product design, a valuable exercise in itself, but the problem remains of where and how these technologies can be developed and marketed.

In Chapter Eight there is an attempt to understand why alternative strategies remain only rhetorical or experimental. The political commitment to change does not necessarily lead to different routes of technological development - the missing ingredient is power (Noble 1983a, 1983b).

The analysis of technological change reaches an impasse in informing practical action. There is a tendency to get stuck in the circular argument that the ability to shape technology is power-dependent and so changing society is necessary to change technology: but society cannot be changed without changing technology and so on (see Bruce and Mole 1987).

In Chapter Nine the conclusions are presented and an attempt is made to salvage alternative strategies for technology from this impasse and offer some indicators for a local authority 'alternative' technology policy in the form of design and technology education and the creation of an alternative technological hegemony. In addition, areas of further research are identified.

CHAPTER ONE: THE INNOVATION PROCESS.

1.1 INTRODUCTION.

The structure of advanced industrialised societies is closely related to the state of technological knowledge and development. This is illustrated, for example, by work patterns, communications and the consumption of products and services. At the core of technological development is the innovation process or the way in which new products and processes are designed, developed and adopted in society.

This chapter looks at the innovation process. The main literature in the field is reviewed with the purpose of exploring how technological innovation occurs. The concepts of 'technology-push' and 'demand-pull' are introduced, and a synthesis of their arguments is used to construct an 'interactionist' model of the innovation process. The concept of 'technological paradigm' is applied as an explanatory tool to consider the influence of government and other factors on the selection and direction of technological developments. The underlying purpose is to focus on the relationship between technology and 'needs', and question why certain technologies are developed and others are not.

1.2 DEFINITIONS.

The first step is to define what is meant by technology. A wide spectrum of definitions may be found in the literature ranging from technology, narrowly defined as apparatus or machine hardware and software, to definitions that are much wider and include factors such as knowledge, skill, organisation and social and cultural systems (Winner 1977, Layton 1974).

In an article concerned with a more precise conception and definition of technology, Kline (1985) points to four usages of the concept:

Usage 1: technology as hardware (or artefacts); non-natural objects of all kinds manufactured by people.

Usage 2: as a socio-technical system of manufacture; all the elements needed to manufacture a particular kind of hardware, the complete working system including its inputs; people, machinery, resources, processes and legal, economic, political and physical environment.

Usage 3: the information, skills, processes and procedures for accomplishing tasks, a possible denotation as knowledge, technique, know-how or methodology in the usual sense of these terms.

Usage 4: a socio-technical system of use; a system using combinations of hardware, people (and usually other elements) to accomplish tasks that humans cannot perform unaided by such systems (pp 215-218).

In this thesis, the concern is to explore technology in its design/development context and in its context of use. Clearly, the definition of technology needs to be able to include the complexity of forces that influence the innovation process. Thus technology is defined as a wide-ranging system; the context in which artefacts are designed, developed and used, and the knowledge and expertise required to maintain the technological system (Layton 1974), together with the societal and institutional processes of government, the market and so on that shape technological development. For example, the car makes sense as an artefact only if supported by a transport system, a network of roads and maintenance facilities. As a technology it has wide-ranging impacts, including implications for urban planning, the nature of cities and so on.

As an area of study, technological innovation has been dominated by economic analyses. The first three usages of the concept of technology identified by Kline have been dealt with by this economic perspective. However there has been relatively little attention paid to the context of use. Coombs, Saviotti and Walsh (1987) support this point when they note that;

'.. for analytical purposes, innovation studies exhibit an autonomy of scientific and technological practices from their social context', they argue that this 'aids an understanding of technological innovation as a process in its own right and helps to relate innovation to social and political factors that affect its development'(p.6) The danger inherent in this separation of technological practice from its social context is that technology as a concept becomes more narrowly defined as technological practice. The social context of technology has been more effectively dealt with in sociological analyses of technology. In order to explore technology from both perspectives, this chapter is concerned with technological innovation in the general framework of economic analyses. Chapter Two looks at technology from a sociological perspective.

Technological innovation refers to the process of creation, evolution, development and implementation of technological artefacts. The innovation process involves a series of stages typically, though not necessarily in this sequence, ranging from the idea or invention through product design, development, production, market adoption and diffusion. Certain theorists use the term 'technological innovation' to define this whole process. Roy (1986) refers to the definition adopted by the Organisation for Economic Co-operation and Development (OECD) in the 'Frascati Manual' (a document issued as a proposed standard for measuring scientific and technical activities). Here, technological innovation is described as:

'the transformation of an idea into a new or improved saleable product of operational process in industry or commerce' (Roy 1986 p.2).

In this view, innovation is a process by which new products and processes are conceived, developed and launched.

In more purely economic approaches to the study of innovation this definition is modified and invention is distinguished from innovation. Mansfield writes; 'an invention, when applied for the first time, is called an innovation (1968 p.83). In this definition, innovation refers to the first introduction onto the market or into use of a new product or process. This distinction was also made by the economist; Joseph Schumpeter, he regarded 'invention, the discovery of a new tool or technique, as the initial event, and innovation; the implementation of the new tool or technique as the the final event' (cited in Kelly and Kranzberg 1978 p.2).

The distinction between invention and innovation is useful because it points to the difference between the discovery of new products and processes and their eventual application. Indeed, only a proportion of all inventions ever reach the point of commercial or social use and many inventions do not become innovations at all.

The process of converting an invention into an innovation involves a number of phases. A separation between the terms 'science', 'technology' and 'technique' is often used in the literature to identify different points in the innovation process. Emmanuel (1982) defines these terms;

'Science refers to the discovery of pure scientific knowledge that is not immediately applicable, while technology refers to the application of knowledge to a particular problem. Technique is the actual production and diffusion of this knowledge in the form of commodities'.

In this way, technology is defined as knowledge and technique as processes. For example, medical technology refers to the overall development and improvement of medical techniques - pacemakers, kidney machines and so on.

In the economic literature on innovation and the management of innovation the factors relating to the commercial success of products, processes and the innovating firm; research and development (R and D) capacity, management strategies, marketing techniques and macro-economic factors within the economy as a whole, comprise the units of analysis. The emphasis is on the process of technological development rather than the technology itself.

Another distinction apparent in the literature is that made between 'radical' and 'incremental' innovations. 'Radical' innovations refer to products and processes that result from advances in knowledge, for example, the motor car or the electric light bulb. 'Incremental' innovations refer to the continual process of improvement of techniques. For example, since the invention of the motor car there have been substantial changes and improvements which clearly differentiate the modern Ford Escort from the Model T Ford. The distinction between radical and incremental innovations is not clear-cut and many innovations are difficult to categorise in this way. The colour television, for example, resulted from a series of incremental changes but has had radical effects. Likewise the zip fastener resulted from R and D advances in knowledge but could be seen to represent an incremental innovation in terms of the development of types of fastener (Rybczynski 1985).

1.3 ORIGINS OF THE TECHNOLOGY-PUSH AND DEMAND-PULL DEBATE.

The precise nature and cause of technological innovation is subject to controversy and debate. In the literature two main models are used to explain the determinants and rate of technological innovation. These are, respectively, technology-push and demand-pull (Langrish et al. 1972).

The technology-push perspective looks to advances in science and technology as the major determinants of change in the composition of products and processes. In this approach the central role of science in producing invention or the dependence on previous advances in technology to stimulate inventive activity is emphasised.

The demand-pull model of how innovation occurs identifies needs or demands as the main influences on innovative activity. Utterback (1974) states that; 'needs' may be in the form of market demands, government or military requirements and social needs. Producers attempt to link technological effort to the fulfilment of needs.

These theoretical concepts originated in the work of two economists, Schumpeter (1934) and Schmookler (1966). Both of whom recognised the importance of technological change to economic development, but favoured different explanations. For Schumpeter, work on long-term economic development and structural change in capitalist societies, resulted in the importance of technological supply over the adaptation of technology to demand as an explanation for technological innovation. For instance, he proposed that the introduction of radical new ideas by individual entreprenueurs or large firms was the only way to generate new industrial sectors. Technology was seen as the major factor for economic growth (Schumpeter 1934). In his later work he recognised the growing institutionalisation of R&D (Schumpeter 1943, Freeman et al. 1982). In this way Schumpeter's ideas represented a technology-push argument.

Schmookler, on the other hand has often been regarded as the exponent of a demand-pull theory of innovation (Coombs, Saviotti and Walsh 1987). In the first half of this century Schmookler studied investment, stocks, employment and inventive activity in several industrial sectors in the USA. He concluded that fluctuations in investment could not be adequately explained by inventive activity, in fact, quite the reverse, an increase in inventive activity was a response to increasing demand (Schmookler 1966). Although the main focus of his research tended to be on demand factors, Scmookler did not argue that demand forces were the only determinants of innovative activity. He used the metaphor of the two blades of a pair of scissors to represent invention and demand as two interacting forces (Coombs, Saviotti and Walsh 1987).

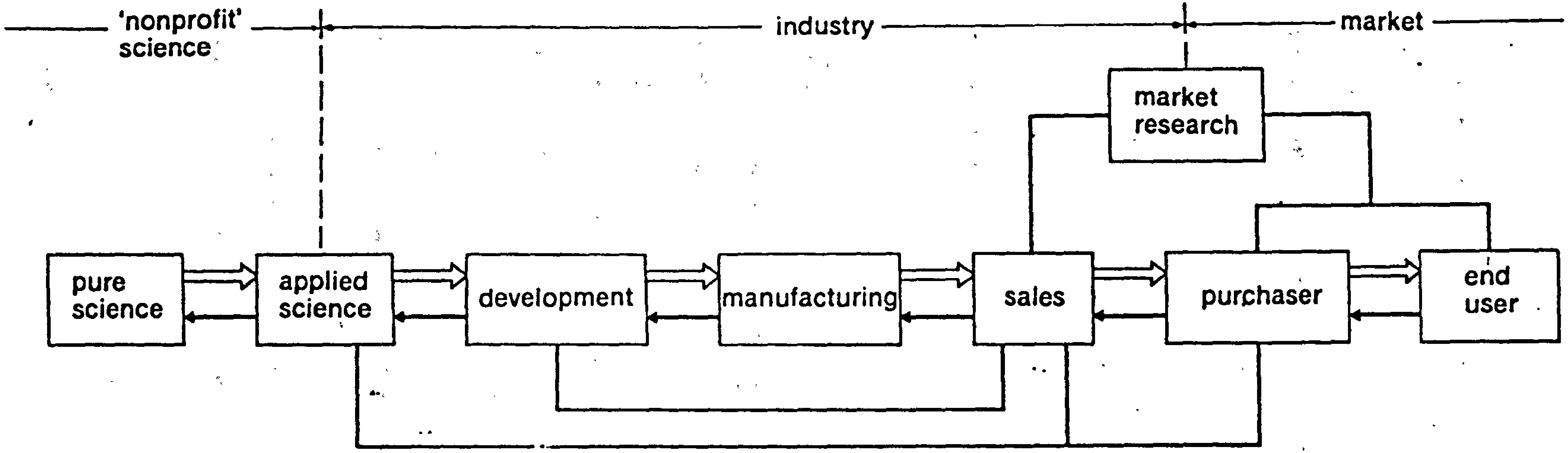
The theoretical debates about the origins of innovation have developed against this background. During the 1960's and 1970's empirical investigations of innovations sought to reveal the major factors influencing innovative activity. The aim was to identify the importance of technological innovation to economic growth.

Studies of technological innovations tend to be quite diverse, some concentrate on incremental innovations (Myers and Marquis 1969, Utterback 1974, Von Hippel 1976, Mansfield 1977). Others are based on investigations of radical innovations (TRACES 1968, Freeman 1974, NSF 1975). The units of analysis also vary, for example, weapons systems in

HINDSIGHT (Sherwin and Isenson 1967), innovations in TRACES (1968), firms in Carter and Williams (1957) and Langrish et al. (1972), and industries in Myers and Marquis (1969) and Project SAPPHO (SPRU 1971). (For a review of innovation studies see Rothwell 1977, Coombs, Saviotti and Walsh 1987).

Methodological differences and definitions are also evident in these studies. The identification of stages in the innovation process were often based on a linear sequential model (See Figure 1). Critics argued that that was an oversimplification of innovative activity (Langrish et al. 1972). There were also differences between the time period for investigation of innovations. Mowery and Rosenberg (1979) argued that this heterogeneity precluded the comparability of findings. However, they conceded that certain indicators suggested that demand (or need) was the most important determinant of the innovation process.

In general, studies of innovative activity indicate that an understanding of user needs, good communication and effective collaboration tend to be associated with the commercial success of innovations (Rothwell 1977, Rothwell and Walsh 1979). Despite this, Mowery and Rosenberg (1979) argue that given the wide definitions of 'need' and 'demand' factors present in the studies, (for further discussion see 1.5), the evidence is too ambiguous to suggest that demand



Linear model of the innovation process

FIGURE 1.

SOURCE: WALKER (1986)

is the major factor or determinant of innovative activity. Langrish et al. (1972) support this view with the argument that it is only through the arbitrary selection of a point at the beginning of the innovation process that it is possible to categorise innovations as a result of market demand or technological opportunity.

1.4 TECHNOLOGY-PUSH.

Empirical studies of technological innovation face difficulties with relating innovation to purely technology-push or purely demand-pull models. The relationship between science and technology was found to be interactive. Technology could not be explained as the result of the application of scientific knowledge alone. Rosenberg (1982) points to instances where technological knowledge has preceded scientific knowledge and provided the base for scientific research. For example, Torricelli's demonstration of the weight of air in the atmosphere, an important scientific breakthrough, was a result of his attempt to design an improved pump. Pasteur's development of the science of bacteriology began with his attempt to deal with the problems of fermentation and putrefraction in the French wine industry. Further, Rosenberg (1982) argues that on occasion the form of technological development in a particular industry can lead to the need for further scientific research. He gives the example of the aircraft industry where the turbo-jet led to the creation of a new supersonic aerodynamics.

A central question that emerged from such studies concerned the utility of a linear sequential model of the innovation process (see Fig. 1). The linear sequential model defines certain stages in innovative activity beginning with research or the recognition of demand and culminating with the introduction of the product onto the market. Technology-push explanations of innovative activity which rely on this model are unable to account for the time lag between invention and innovation, in some cases this can be many years if it happens at all. In addition there are time lags between pure research and innovation. For example, the Bacon fuel cell was first observed in 1842 by Sir William Groves. It was not until the 1960's when huge investments were put into the US Space Programme that it was developed and produced in order to play a key role in the technology used to put the first astronaut on the moon (Guardian 11.4.86). Haeffner (1973) argues that in its purest form technology-push assumes that there is not a dependence between innovative activity and economic and demand factors. Clearly, however, economic and demand factors influence the development of technologies and are indicative of why certain technologies are developed whilst others are.

In capitalist market economies the technological sphere is inflenced by powerful economic needs and incentives. The allocation of scientific resources for research and development to a great extent depend on the perceived financial rewards to be gained. The increasing institutionalisation of R and D in private industrial and government financed laboratories supports the view that the pursuit of research is largely directed and limited by economic costs and benefits (Freeman 1982).

The technology-push argument for innovative activity demonstrates a diversity amongst industrial sectors. In a study of a number of innovations in the areas of process plant, synthetic materials and electronics it was found that a distinctive feature of these industries was that they were research-intensive (Freeman 1982). In addition these areas represented the three main sectors of fast growing new products, identified by research undertaken during the 1960's and 1970's by the National Institute of Economic and Social Research (NIESR) and the Science Policy Research Unit (SPRU). The conclusions drawn that there were significant correlations between research and development efforts and innovative output in these sectors appears to support a technology-push argument. However, if the electronics industry is taken as an example then the importance of economic and institutional factors for innovation is evident.

Freeman (1982) gives a brief history of the electronics sector. The origins of the radio industry at the beginning of this century were followed around the period of the Second World War by three of the most important innovations in the electronics industry; television, radar and the computer. All of these innovations were largely influenced by advances in fundamental science; solid state physics. But factors apart from their technological capability were important for their development. In the field of radar and computers the close relationship between the scientific community and industrial and military users was a key factor in the innovation process. Wartime military demand spurred on many new technical developments which, after the war, were not met by commercial demand for a fairly long period. For example, the growth of the European semi-conductor industry was slack in the face of an absence of strong market demand. Freeman, Clark and Soete (1982) argue that throughout the period of technology-push until commercial innovations got underway, the combination of government-sponsored, university and industrial research and development was crucial for innovation in this industry. Clearly, certain industrial sectors are more closely related to scientific and technological research than others.

Technology-push explanations are useful for understanding radical innovations. Langrish et al. (1972) argue that the radical innovations in the electronics industry may be explained more fully by technology-push perspectives rather than demand-pull. This is a point supported by Dosi (1982) who argues that for demand factors, particularly market demand, the technology must already exist. Demand factors cannot affect a technology until it has already been invented. Rosenberg (1982) suggests that radical innovations; the major technological breakthroughs, signal only the beginning of a series of technological developments that may provide a new technological framework or trajectory, and shape subsequent research and development for many years. However, for an understanding of incremental innovations the technology-push argument is not sufficient. Once a major breakthrough delineates the direction of further research and technological improvement then demand factors are central to the continuation of innovative activity.

Empirical research findings suggest indirect relationships between science and innovation. Most innovations are not a result of the direct application of basic scientific knowledge (Myers and Marquis 1969, Langrish et al 1972). Rather science acts in conjunction with market demands for on-going innovative activities. Science assists in the resolution of technical problems (Gibbons and Johnston 1970, Rosenberg 1974). When science does facilitate innovation it tends to be rather indirect, Langrish et al (1972) point to the ways that this can occur:

'First, curiosity oriented science, practiced largely in academic institutions, provides techniques of investigation. Second, it also provides people trained in using these techniques as well as in scientific ways of thought in general... Third, science enters innovation already embodied in technological form. It may be relatively rare for a piece of curiosity oriented research to generate a piece of new technology, but once this process has occurred, the technology can be used over and over again and developed into more advanced technology' (p.40).

The interaction between science and technology, scientist and technologist, is discussed more fully in Chapter Two (see Barnes 1982, Hughes 1986). The conclusion that can be drawn here is that science is one of the factors that make up the innovative environment, but it is not necessarily the main determinant of innovation. The growth of institutionalised R&D (Freeman 1982) confirms the significance of scientific and technological research for innovative activites in certain industrial sectors. Demand and institutional factors (especially government and military support) are important for the transformation of an invention into an innovation, and in the support for selected paths of scientific and technological enquiry. For example, Information Technology (IT) has been supported by a major government initiative; the Alvey Programme (Alvey 1982).

1.5 DEMAND-PULL.

So how do demand factors affect the innovation process? Pure demand or market-pull models point to the recognition of a need as the main stimulus to innovation. Needs may be in the form of market demands, government or military requirements and social needs (Utterback 1974). Producers link technological efforts to the fulfilment of these needs and demands.

The market is a mechanism whereby suppliers and consumers are brought together to facilitate the exchange of goods and services. Within capitalist market economies, the market presupposes the existence of purchasing resources. Market needs are in effect economically backed demands. The economic significance of demands is the key factor in the connection between technological innovation and the market. The demand-pull perspective stresses the primacy of market forces in both the capital goods and consumer goods market. Demand factors may also be in the form of government markets or particular forms of needs. For example, British wartime needs spurred the successful development of radar (Freeman 1982). The influence of government and social needs on the innovation process will be discussed later, first the demand-pull theory is discussed more fully and the insights that it can produce for the understanding of the innovation process are identified.

Demand factors as an explanation indicate that it is possible to know the direction in which the market is pulling inventive activity before an invention takes place. A number of empirical studies tended to support this view (Myers and Marquis 1969, Langrish et al. 1972, Rothwell et al. 1974, Sherwin and Isenson 1967). The main conclusions drawn from these studies was that factors relating to the market were important, particularly the close connection between the success of an innovation and the understanding of market and user needs. One of the major difficulties with these studies is their different definitions of needs and demands. Market demand in Mowery and Rosenberg (1979) is not the same as Utterback (1974) conception of needs, thus Mowery and Rosenberg have argued that the aggregation of these studies into a demand-pull theory of innovation is questionable. Market demand refers to the satisfaction of certain classes of 'user needs'. For example, Myers and Marquis (1969) study innovative activity in the producer goods industry, a sector which displays a large degree of 'consumer sovereignity', as compared to the consumer goods industries. In addition, this study concentrates on 'successful' innovations so that it exhibits a selection bias. In their schema demand can refer to either current or potential market demand, thus the concept becomes an all-encompassing one which loses any precise operational definition. Mowery and Rosenberg argue that potential demand may exist for anything under the sun, and the mere fact that an innovation finds a market can scarcely be used as evidence of the undisputed primacy of 'potential demand-pull' in explaining innovation (p.107)

Theoretical and methodological weaknesses apart, a major shortcoming of this perspective is the ability actually to provide an adequate explanation of the innovation process. As an explanation, innovation theory must include various types of innovations, both incremental; the technical improvements to existing products and processes, and radical innovations; the major technological breakthroughs. There are several reasons why demand factor explanations as the major determinant of innovative activity are inadequate.

First, in relation to the radical category of innovations. Potential needs and demands in this area are possibly limitless, it is problematic to conceive of how these potential needs and demands trigger innovative activity at a given point in time (Mowery and Rosenberg 1979). A related point is made by Dosi (1982), he argues that one cannot express a need for a product that does not already exist, for example, a need for a car could not be expressed until a car had been invented. In a similar way the need for an improved means of transportation could have been satisfied by a horse, or a bicycle and so on. Therefore innovative activity in terms of major technological developments that do not have a direct relationship with the market remain unexplained.

Second, the why and when of particular technological developments and not others, together with the timing of such developments is unaccounted for. Demand pull explanations fail to confront the specific events within the innovation process between the recognition of demand by producers and the end result; the appearance of a new product. Dosi (1982) develops this argument. It would seem that technological possibilities are already in existence but that they have not previously been exploited. The question that arises is why is this the case? If it can be argued that technological innovations are dependent on needs and demands then the picture that emerges is one of a technology that is extremely versatile and which can be guided in any direction at any time. This results in a crude conception of technology as an essentially passive, reactive mechanism; a 'freely available blackbox'(Dosi 1982 p.147).

Third, Bruce (1984) in her study of the development of interactive videotex raises the question: what is the mechanism by which needs for new ideas or demands coincide with innovators of new ideas? There are no simple mechanisms which generate needs or supply ideas. Needs may not be articulated and different groups have different needs which may conflict. The supply of ideas depends on the state of knowledge at particular moments in time and the ideas may not correspond with needs.

Fourth, the existence of needs or demands for, for example, better health care (a topical example is the National Health Service) do not necessarily lead to their satisfaction (Rosenberg 1976).

1.6 INTERACTIONIST MODELS OF INNOVATION.

To achieve a comprehensive picture of the innovation process, the reliance on either demand-pull or technology-push perspectives discussed above is inadequate. The use of both models is more helpful. In this way, innovative activity is explained by recourse to the role of both technological and market factors in successful innovations. Mowery and Rosenberg (1979) support this view noting that;

'Both the underlying, evolving knowledge base of science and technology as well as the structure of market demand play central roles in innovation in an interactive fashion (1979 p.105).

Innovative activity is what Freeman terms a 'coupling' process. An idea 'gels' or 'clicks' somewhere at the ever-changing interfaces between science, technology and the market (Freeman 1982 p.168). Innovation may be characterised as a response to a 'need' or 'demand'. On the other hand, it may involve existing or new scientific and technological knowledge resulting from research activity. Experimental development and design, trial production and marketing involve a process of matching the technical possibilities and the market (Freeman 1982 p.166).

The technology-push/demand-pull debate has revealed the innovation process as a complexity of interacting forces that cannot be explained by recourse to the importance of science or user needs and demand factors alone. A basic uncertainty is present in all attempts to introduce new innovations and reliance on only one of these factors alone can lead to 'failures'. The most important conclusion from the SAPPHO study (SPRU 1971) of the determinants of success and failure in industrial innovations was that successful innovations (innovations were judged in terms of commercial success) were those that matched the technology with the market, consumer and user requirements were understood and adequate resources were made available for research, development and the launch of the innovations. Whilst this conclusion may appear rather obvious, the influence of the debate has led to further empirical investigation of innovative activity in particular industrial sectors, for example, the Science Policy Research Unit (SPRU) has made studies of synthetic materials, chemical and electronics industries (Walsh et al 1979, Walsh 1984, Dosi 1981) which incorporate both theoretical perspectives. Findings from these studies reveal that neither technology-push nor demand-pull activities predominate but that each one may be paramount and can lead the other at different stages of industrial development.

Freeman et al. (1982) suggest that if generalisations are required then it could be argued that technology-push is relatively more important in the early stages of industrial development, whilst demand-pull assumes more relative importance in the mature stages of the product cycle. Abernathy and Utterback (1975) point to the changing patterns of innovation relative to the maturity of an industry, they link radical product innovation with subsequent incremental product innovation and process innovation over the life-cycle of an industry. This accounts for the re-adaptation of products in a similar way to the innovation spiral model discussed below.

The interactive model of the innovation process is dynamic and can account for change both in technological opportunity and in demand factors. The innovation process is not seen as static or confined to particular stages. For example, Rothwell and Gardiner (see Walker 1986) in a study of the Hovercraft industry, found that the adoption or diffusion of an innovation can lead to re-innovation and re-adaptation of the product or process.

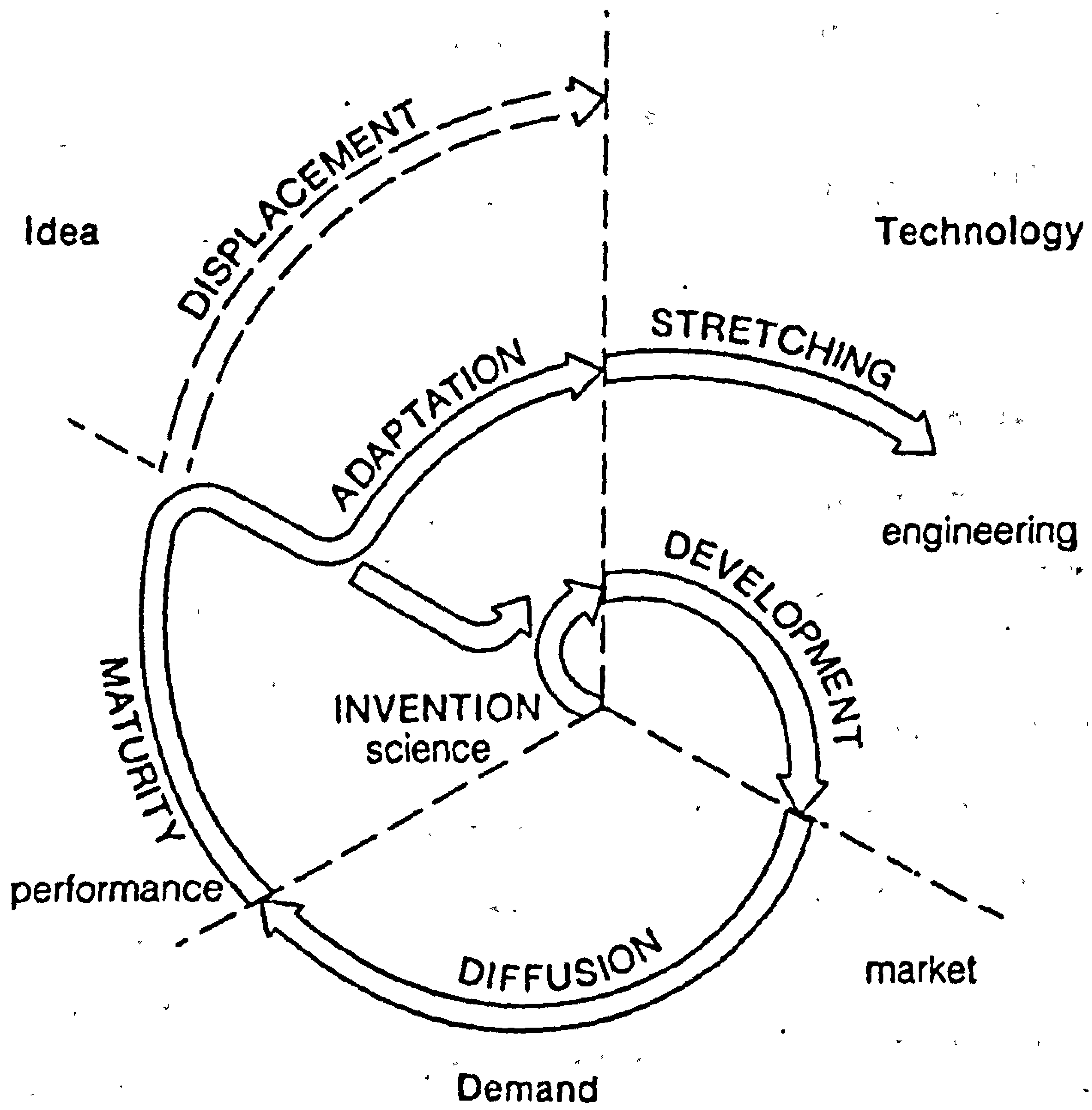
A model of the innovation process needs to recognise the inter-relationships between different phases or practices within the process. In addition, it requires the ability to present a dynamic process that is constantly changing through interaction with the wider technological environment and the market.

The 'innovation spiral'(see Figure 2) is a model of innovative activity (see Walker 1986) which recognises its dynamic quality. The spiral illustrates an invention and development phase which is affected by technology and engineering. A diffusion stage which is affected by market and demand considerations. And a stage of maturity of an innovation which leads to either displacement, adaptation in terms of re-design and product stretch or re-invention which brings the innovation full circle. The spiral represents an evolutionary model of innovative activity that can account for change and for the affect of outside factors central to innovative activity.

Within this model a key role is given to design and the re-design of products and processes. Walker argues that design lies between technology-push and market-pull:

'Design then occupies the centre of the innovative process because it converts general ideas and needs into specific objects' (Walker 1986 p34).

An important point to be made is the relation of design to



Innovation spiral. Main phases

FIGURE 2.

SOURCE: WALKER (1986)

technological capability; the technology exists and there are a number of ways that design can use this capacity. A crucial determinant is the priority given to particular criteria; cost-reducing criteria, ease of manufacture, user requirements, particular market focus and so on. The design of a product or process reflects specific aims. These may be economic considerations, political considerations, social criteria and so on.

The discussion of induced innovation in Coombs, Walsh and Saviotti (1987) supports this view. The work of David (1975) is cited as indicative of the process whereby learning by doing (Arrow 1962) or experience can create a more direct link between the origin and diffusion of a given technology. It is argued that the choice of a technique, initially, will result in a technological learning process that leads to the development of similar techniques. Rosenberg (1976) presents an argument for a complex environment of technological activity whereby the inducements to innovation can take the form of a diverse range of factors. These may include scarcity of raw materials, bottlenecks in technological developments, and political factors. He gives the example of efficiency requirements in the development of the textile industry. Once innovations had increased the efficiency of spinning, the need to avoid a productivity bottleneck at the weaving stage led to the introduction of innovations to increase the efficiency of weaving. In a further example, Rosenberg argues that the nineteenth century textile industry in Britain exhibited a labour-saving bias. Industrialists sponsored labour saving innovations in order to avoid strikes and to overcome labour's reluctance to accept their conditions (cited in Coombs, Saviotti and Walsh 1987). The political and social influences on innovative activity will be discussed in Chapter Two.

The picture which emerges from this discussion of innovation is one of a solution-focused activity. Innovative activity develops in response to various conditions, or to use Rosenberg's term 'bottlenecks' in technological and industrial systems (Rosenberg 1976, see also Hughes 1983 for a discussion of reverse salients as key factors in technological development). Here innovative activity arises as a result of previous advances in technological development.

This evolutionary model of innovative activity is related to innovation at the level of the firm. Rosenberg (1982) argued that radical innovations laid the foundations for technological trajectories (Nelson and Winter 1977). Technological trajectories refer to paths of technological development. Complementary technologies and technological improvements arise from an evolutionary progression where technology builds on existing technology in an incremental or step by step manner (see also Ray 1985). This idea has been developed by Dosi (1982) in terms of technological paradigms and technological trajectories.

A technological paradigm refers to a 'model' or 'outlook' that is brought into existence by a 'radical' innovation. For example, advancements in solid state physics influenced innovations within the electronics industry. The technological trajectory refers to the continuous improvements, such as computers within the electronics paradigm. For Dosi (1982) the technological paradigm;

'... is an outlook, a set of procedures, a definition of the relevant problems and of the specific knowledge related to their solution ... each technological paradigm defines its own concept of 'progress' (Dosi 1982 p.148)

The concept of paradigm is based on Kuhn's (1962) theory of scientific paradigms. Within Dosi's view the paradigm includes certain possible technological alternatives and routes to future technological developments. For example, if nuclear technologies are selected as the model then energy problems are defined by nuclear technological solutions. The word selected is the operative one here. This argument is not to suggest that technology develops of its own accord in an autonomous fashion, on the contrary there are always alternative routes of technological development (see MacKenzie 1987). The selection environment for technological development will be discussed below and in Chapter Two.

Dosi further suggests that the acceptance of particular technological paradigms can play a powerful prescriptive role with regard to the selection of routes of technological development. That is, solutions to technological problems are provided by specific technologies and not others, for example, to return to the subject of energy the technological paths defined by nuclear power mean that other energy technologies, such as wind power and solar power are excluded from widespread development.

The exclusion effect of technological paradigms is important because of its negative effects on technological alternatives. Dosi notes;

'that the efforts and the technological imagination of engineers and of the organisations they are in are focused in rather precise directions while they are, so to speak, 'blind' with respect to other technological possibilities (Dosi 1982 p.153).

Progress is defined in terms of the paradigm. The questions which this framework of thinking about innovative-activity raises are: why did certain technologies emerge instead of others? How are technological paradigms established? What are the factors which act as 'selectors' in the sense of identifying certain paths of development within a larger context of possibilities.

Discussion of the innovation process suggests that trajectories of development are influenced by economic factors; market demand and profitability, together with the technological capability of the enterprise, and political and social factors. The wider social and political environment influences the selection of technological paradigms that act to institute technological trajectories.

This can be seen in relation to the interaction between technical possibility and user needs. This interaction is a dynamic process; user needs and the particular technical solutions to these needs are likely to change. Different technologies provide the solution to user problems. For example, the problem of cooking can be met in a number of different ways and with quite different technologies. The crucial factors are the context of use, particular user requirements and available resources ie. the difference between the primus stove, the gas cooker and the microwave oven. Within one particular trajectory of technical solution new innovations can be stimulated by the users perception of the inadequacies of the existing technical solution on offer. The technical advances arising from user needs involve more appropriate ways of doing things (Ray 1985).

At the level of the firm, innovations embody the technological knowledge required to produce the innovation, thus for a firm operating in a particular sector and market, products and processes comprise the cumulation of knowledge and perceived problem-solution factors necessary for their continued product development. Producers tend to work within existing technological trajectories. This is a point made by Rosenberg (1982) when he notes;

' Specialist producers tend to be very good at improving, refining and modifying their product. They tend to be weak in devising the new innovation that may constitute the eventual successor to their product (Rosenberg 1982 p.129).

The criteria for the assessment of product and process innovations developed by Ray (1985) indicates that to be successful innovations need to complement surrounding technologies, correspond with user needs, have some advantage over competing technologies and be offered at an appropriate price. The evaluation of products and processes in these terms offers an explanatory device for successes and failures of innovations on the market. For example, the Sinclair C5 electric-powered car offered a form of low cost transport but did not correspond with other user needs of safety and speed. Further, it was not in harmony with existing technologies and did not have enough advantages over competing technologies. Concorde corresponds with user needs for faster air travel and in this way has some advantages over competing technologies but the price precludes its use for mass air travel. The implication of Ray (1985) criteria for innovations is the tendency for technologies to develop along existing trajectories in an incremental fashion. Product design, re-design and re-adaptation comprise a large part of innovative activity once a trajectory has been established. For example, re-innovation and adaptation have been key factors within the car industry which has a history of improved design configurations, engineering specifications and safety improvements within a model range.

The picture of the innovation process which emerges from this discussion is one of a complexity of activities which at different times and in different contexts leads to innovations.

1.7 THE SELECTION PROCESS.

The factors which have been identified as important to innovation are the match between technological capability and market demand. Once the technological capability exists then demand will have an 'inducement' effect on surrounding technologies. The design of the product or process depends on user needs, and the political and social factors which feed into the solution requirements or brief for the technology. Ray's (1985) assessment criteria for product innovations suggests that they need to fit into a sort of cultural brief or to use Dosi's term an overall technological paradigm. A result of which is the powerful exclusion effect for technologies that operate outside of this paradigm.

If the central question of why certain technologies are developed whilst others are not is addressed then the above scenario has a powerful intuitive appeal.

The technological environment for innovative activity is influenced by economic and ideological factors that favour certain routes of technological development. Investigation of the link between innovation and economic growth, which is the aim of many of the empirical studies of innovation, acts as a powerful prescriptive argument. More and increasingly sophisticated technologies are advanced as the route to increased competitiveness in world markets.

This economic view of technology is matched by a more general ideological view, in which technology is equated with human progress. The level of development of machines, materials and tools employed in the creation and maintenance of the human environment serves as an indicator of technological advance and by implication of societal progress, for example, the association of information technology with the Post-Industrial Society which is information or knowledge-based (Bell 1974).

Having acknowledged the strong cultural bias towards technology development, how does this then affect innovative activity at the level of the firm. Innovative activity operates within the context of uncertainty and risk. Nelson and Winter (1974) argue that firms are concerned with economic stability so that if markets allow they will use the same production techniques for considerable periods of time. Change does occur, but this is likely to be in response to 'threats' to their economic and market position. This is akin to the idea of induced innovation put forward by Rosenberg (1976) and discussed in the previous section.

Technological trajectories (Nelson and Winter 1977) are the patterns of product and process activity central to the maintenance of an enterprise. The competitive environment within which firms operate ensures that within a particular industrial sector, these trajectories may be common to the majority of firms. Coombs, Saviotti and Walsh (1987) argue that this means that each firm will not only adopt technological solutions and approaches which are going to remain stable for short periods of time, but which are also similar to those adopted by other firms operating in the same technology. This is the likely situation for mature technologies.

Utterback and Abernathy (1975) introduced the concept of dominant design. A variety of designs may be present in the initial stages of the industry, the dominant design emerges as the industry matures. In a similar context Sahal (1981) introduced the idea of technological guideposts, and Dosi (1982) uses the concept of technological paradigms to illustrate these trajectories. The implication of this work is that individual enterprises are constrained in the technological options open to them. Changes in market demand will tend to result in incremental innovations, within the existing technological trajectory, to a particular product or process rather than a whole new solution. A point emphasised by Rosenberg (1982) in the previous section. At certain times, change will occur, this is likely when existing technological regimes and natural trajectories are no longer as commercially viable. To maintain their position in the industry, firms are induced to change to more appropriate regimes and trajectories. Coombs, Saviotti and Walsh (1987) give the example of the jet engine. It became the dominant technological regime in aircraft when no further improvements in speed appeared possible by redesigning the combination of piston engine and propellor.

Natural trajectories may be specific to particular industries. Nelson and Winter (1977) also argue that there are natural trajectories which are common to large numbers of industries over long periods of time. Mechanisation, the exploitation of latent scale economies and the tendency to an increasing use of electricity are examples of more general trajectories. The existence of trajectories, technological guideposts and so on have not been subject to analytic investigation. However, the arguments have intuitive appeal and support the contention that changes in demand are rarely the determining factor for a shift of technological regime, paradigm or dominant design (Coombs,Saviotti and Walsh 1987). The implication is that technology operates in a system whereby the opportunities for alternative routes of development are constrained by powerful economic and technological factors.

1.8 GOVERNMENT.

For all innovations, finance plays a central role. The technological 'know-how' may exist but until investment is considered necessary for continued competitive advantage and potential profitability, then technological potential will not be transformed into an actual product or process. One finding of the empirical studies of innovation is the uncertainty involved in all attempts to innovate. However, with 'incremental' innovations the risk is considerably less than with 'radical' innovations. Indeed, as Walker (1986 p.25) says;

'... radical innovations come from an attack on matters of principle.... incremental innovation and new product designs come from the application of engineering practices to design details. Moreover, the first route is now more likely to be funded through government agencies. While the second route operates by typical market forces'.

Technological support and technological regulation are the two main functions of government intervention in innovation (Johnston and Gummett 1979). The assumption that increasingly sophisticated technology results in higher economic efficiency and competitive advantage in international markets is a strong motivation for governments to support technological innovation. In other areas, governments promote goods and services, such as basic research, education and military technologies.

Regulatory activities by governments are designed to allay fears about the potentially undesirable social and environmental impacts of technology.

A further point is made by Coombs, Saviotti and Walsh (1987) when they argue that state intervention in technology has both an economic and a political function. Changes in technology can affect the balance of power among different groups in society and result in the state as mediator. Technologies which replace jobs have implications for workers and trade unions. Regional inequality can result from the unequal diffusion of technologies. State intervention in political/technological problems has been matched by the growth of pressure groups concerned with the political redistribution of decision-making on technological issues such as the protection of the environment; weapons proliferation and the diffusion of nuclear power.

The development of science and technology policy by governments involves the selection of areas to support. For example, the choice to support basic research raises questions of how can science and technology be controlled and planned most effectively? By what criteria and in whose interests? Government resources are allocated to certain areas of research, development and design in response to signals from the market, or from industrialists, or from international sources on the perceived potential benefit of support for the technology. Technological change is therefore the result of decision-making at the very earliest stages of technological development.

The underlying rationale for government support of research and development is usually based, implicitly or explicitly, on theories relating science and technology to economic growth. Coombs, Saviotti and Walsh (1987) note that in the post-war years science and technology policy was justified with reference to science/technology push theories of innovation and economic growth. During the 1960's and 1970's when demand-pull theories gained ground, spending cuts on R&D were justified by the results of this research.

The technological areas which are generally supported by government may be as follows:

a) the scale of capital investment or R&D investment required for 'high technology' may deter individual enterprises from investment. In these cases the government may sponsor R&D, for example, the British Programme for Advanced Information Technology (Alvey 1982);

b) governments have also provided funds to support certain sectors such as computers and microelectronics, for example the Microelectronics Applications Programme (Braun 1984);

c) basic knowledge is likely to be useful to industry in the long term, but through the market mechanism applied research would tend to be favoured (Shonfield 1981);

d) there are many areas of basic academic research which cannot be said to result in discoveries that lead directly to technological advances. The scientific knowledge produced in these areas provides an infrastructure which influences what industrial researchers, engineers and inventors do, their methods and the knowledge with which they start: but it is often the case that individual industrial investors are not able to appropriate all the benefits of basic research and training activities

(Coombs,Saviotti and Walsh 1987).

e) the defence sector is supported by government. The primary considerations are security and prestige rather than economic. The same considerations apply to projects thought by government to enhance national prestige, such as Concorde. National prestige and strategic considerations played an important part in government support for Rolls Royce in developing the RB211 engine in the early 1970's (Williams et al. 1982).

Other examples point to the decisions to invest in projects that exhibit technological advance and notions of progressiveness but are arguably not the most urgent in terms of social needs. In Britain around two-thirds of total expenditure on medical research is government funded. Whilst heart transplants are an important scientific/technological advance in surgery, no attempt was made to relate the costs of development to the costs of other more urgent socio-medical needs (Freeman 1982 p303). A topical example is the lack of intensive care facilities for chidren receiving heart operations at a hospital in Birmingham (Guardian 7.1.88).

Selection based on powerful political and economic decisions has a great effect on the direction of technological development, and in so doing closes off some options that become starved of research funds. For example, decisions to invest in nuclear power energy options rather than renewable energy sources has left the latter marginalised in the UK.

In 1984, the share of government R&D funds increased for defence projects and the military and prestige 'big technology' sectors; currently microelectronics, information technology and bio-technology. Of the Science and Engineering Research Council funds 'Big Science' consumes almost double the resources of all the remaining natural sciences put together (Martin and Irvine 1984). Moreton sums this up with the words;

'The country is rushing, helter-skelter, into a new technological world of laser beams, electronic beams, computer hardware and software, microfoils, fibre optic technology and diagnostic reagents' (Moreton 1986 p240).

The increase in military R&D acts to diminish amounts of expenditure on civilian projects. Britain now spends a higher proportion of its GDP on military R&D than any other Western nation (New Scientist 1985). At the same time it is the only Western nation with an absolute decline in R&D performed in manufacturing industry, paid for by industry or government (OECD 1985).

A further area of government intervention is the control of unwanted effects of technological change. Concerns about environmental pollution, depletion of scarce resources, health and safety at work, noise, product safety and the invasion of privacy all became political as well as technological issues and most resulted in the introduction of regulations (see Reppy 1979, Kaufman 1984, McGinty 1979).

What this discussion reveals is that governments play a powerful role in technological change. The allocation of adequate resources to the development of technologies is a key factor in their subsequent innovation. For governments economic, ideological and prestige factors tend to dominate decision-making on technological options.

1.9 THE MARKET.

Our discussion of innovation so far points to the interaction between technology and market needs as motivations for improvements in the design of products and continued innovation. It was acknowledged that demand must exist with a host of other factors if technological change is to occur.

In a capitalist economy firms operate within the market. From the market, the firm purchases raw materials, labour, capital goods, technology and so on, and to the market it sells its output in competition with other firms. The market is a mechanism whereby suppliers and consumers are brought together to facilitate the exchange of goods and services. In competitive market economies the market presupposes the existence of purchasing resources. Market needs are in effect economically backed demands. The economic significance of demands is the key factor in the connection between technological innovation and the market.

So how does the market influence innovative activity? In simple terms, at a given time the market consists of a range of goods which satisfy consumer and user needs and demands, their purchasing patterns reveal their desires and preferences. Movements in demand and price, as a result of ,for example, growing incomes act as indicators to producers that certain goods are more in demand. There is a greater need for them or a need for improvements in the products. Thus it is in the producers interest to respond. The market mechanism is presented as the users and consumers power to choose and therefore to influence the innovation process. However, certain factors severely limit this power of choice. For example, access to economic rsources is a constraint on sections of the population. Second, mass production techniques cater to majority interests, the needs of minority groups tend to be more specialised and therefore more expensive. The market does not reflect the diversity of group interests.

'Consumer sovereignty'(Galbraith 1969) is the term used to denote the power of consumer choice, and the subordination of the firm to this choice as reflected on the market. The ideal model presents a picture of the consumer in possession of perfect information and able to choose freely between goods for the best price and quality (Freeman 1982). The competitive market mechanism ensures that suppliers adapt their output to meet these needs.

Criticisms of this model focus on the market as a competitive mechanism. The free enterprise system and the rule of competition between essentially passive firms has been replaced by the notion of monopoly capitalism; the term used by Marx to describe this stage in the historical development of capitalism (Galbraith 1969). What this means is that the producer, in effect, controls prices and output. Galbraith (1969) developed the theory of producer sovereignty to characterise the consumer market as oligopolistic and primarily concerned with product differentiation and planned obsolescence. He argued that the management of consumer demand through advertising further limits the power of the consumer.

In terms of technical innovation, Freeman (1982) points to two main ways in which consumer sovereignity is eroded.

First, the nature of consumer choice is static. Consumers choose between existing goods on offer. However, in certain sectors of technical change these goods will have been the result of decisions to innovate or apply R&D a number of years earlier. Thus, consumers do not have the power to influence the future array of goods. It can be argued that consumers have an indirect influence in the sense that firms are concerned to anticipate demand in order to make a profit. Whilst this may be true, it is also possible to argue that, in fact, those who make the decision to innovate impose their choices above those of the consumer.

Second, the notion of consumer choice also implies the availability of perfect information about the array of goods. The increasing technical sophistication of consumer goods; cars, televisions, videos and the whole range of electronics equipment now on offer, makes it extremely difficult for the consumer to gain access to full and accurate technical information which is understandable to the lay-person.

The market is a restricted and socially-conditioned mechanism. Technologies reflect cultural conditions, for example, goods are linked to beliefs about social status and personal achievement. A primary example is the status that is linked to a Rolls Royce car. Thus the market cannot reflect all aspects of a community's beliefs about social usefulness. Rather, market production is an indirect means of ensuring the usefulness of a product. Commercial success motivates the supplier to make products that will secure economic advantage, products are purchased because of their use in some way. However, the social-usefulness of the products themselves is secondary. For example, it is the profitability of producing pharmaceutical drugs rather than the curing of illness which is the prime motivation of the drug companies.

This discussion of consumer choice on the market points to the constraints on individuals without economic power to influence the innovation process from the demand side. Of crucial importance is the inabilty to influence the future array of goods and services. Although markets act as a selecting device - it is selection within constraint and , as Dosi argues; 'generally among a range of products already determined by the broad technology patterns on the supply-side' (Dosi 1982 p156).

In the capital goods market, needs or demands reflect economic priorities. For example, the need for efficient production processses for products operating in a competitive environment. In the later phases of a new product innovation the emphasis tends to move away from product improvements towards a concern with cost reduction and productivity gains (Gershuny 1985). The requirements of efficiency act as a constraint on choice of production techniques. The needs of management may conflict with the needs of labour for improved working conditions. The acceptability of new production processes will involve a political compromise between these two groups. In the present organisation of the innovation process this compromise will be reached during the implementation stage of the technology rather than during its design and development. In Chapter Two the possibilities of building the 'needs' of different groups into technologies during their design and development will be discussed. For many groups in society the ability to influence the innovation process whether on the supply-side or the demand-side is limited. The recognition of the inadequacy of the market mechanism to meet social needs prompted several local authorities in the UK to introduce technology initiatives based on social need and user involvement in the innovation process.

1.10 TECHNOLOGY AND NEEDS.

There is a contradiction between what technology could provide and what technology actually does provide. In terms of social needs this is reflected in such contradictions as, for example, in the advanced world there are many who still die of renal failure yet heart-transplant surgery is well-developed. In the developing world thousands starve while the West spends millions on developing weapons systems. It is possible to put astronauts on the moon but the provision of movement aids for the handicapped is rudimentary (Mole and Elliott 1987). The list of unmet social needs is endless. These technological contradictions ultimately stem from an unequal distribution of resources among social groups in society. What technology actually does provide reflects the interests of groups in society who have access to economic and political power.

Further, critics have argued that design and innovation reflect the dominant values of the society that gives rise to it (Cooley 1984). This has resulted in challenges to the neutrality of science and technology as they presently socially organised in our society. In Chapter Two the relationship between science and technology and the norms and values of its context of development are discussed. The implications of this argument are relevant here because it suggests that people who are affected by technology in their workplace and their community are unable to influence its conception, design/development and implementation. The increasing institutionalisation and privatisation of R&D, for example, effectively excludes a wide range of social groups who do not have access to expertise or political and economic power from participation in the decision-making process on patterns of technological development.

Decision-making on technological issues is confined to the democratic electoral process once every five years. The mechanism whereby users with unmet needs and producers can meet does not exist. User needs are channelled through the market mechanism, where needs must be translated into economically-backed demands if producers are to respond. This is the basis of the argument that technology does not reflect social needs.

Before discussing the relationship between technological innovation and needs it is necessary to clarify the concept of 'needs'.

Human need is a complex concept which is impossible to pin down theoretically (Gough and Doyal 1985). The debate concerning the definition of needs is akin to the epistemological debate about the definition and nature of 'power'. Obviously power is a useful concept and power relations exist but there is a methodological difficulty in operationalising and measuring dimensions of power (Bruce 1984). In practical terms it is recognised that there are basic needs for food, clothing, shelter and so on which are essential for survival. Maslow (1970) developed a need hierarchy. He argued that human needs are organised in a hierarchical ladder of ascendancy. The needs lowest on the ladder and hierarchy, such as food, drink, control of temperature must be satisified first before other needs become manifest. Maslow characterises the second rung of needs as safety needs. Once an individual feels safe in his/her surroundings then needs for love, affection and belongingness emerge. Maslow also includes the needs for personal achievement and social recognition. Once all other needs are satisfied then the need for self-actualisation requires satisfaction.

Maslow's hierarchy of needs is difficult to analyse empirically and has had little scientific support. However, it does suggest certain insights into needs as a concept. First, it is evident that needs exist. Second, the identification of a criteria of needs satisfaction is a difficult undertaking. Third, that needs are relative, culturally, socially, politically and economically. And fourth, needs are dynamic and constantly open to change.

Once the difficulties of conceptualising the term are acknowledged, then the problem faced is the identification of what the term refers to. The term is intuitively convincing but is used variously to mean market needs or demands and human needs or basic needs or wants. The difference between these uses is important because definitions of need are effected by external factors, for example, needs may be manufactured. The development of Artificial Intelligence techniques and expert-system computer software may lead to market needs for these systems. An obvious point to be made is that needs exist and they can be met in a number of different ways. Food can be bought in a supermarket, home-grown, consumed in a restaurant. The choice via the market mechanism is between existing alternatives on offer and dependent on access to purchasing resources. Needs in this sense can be referred to as individual needs.

Another category of needs is social needs. As an aside, it must be recognised that categories of needs are not mutually exclusive. In a market economy there is an area of public provision where needs are met collectively (Braun 1984). The provision of goods and services that are socially vital but economically inaccessible to large groups of potential users include health care, education and the myriad of social services. Social needs also include needs that are relevant to particular groups of people but which have not received priority on the technological agenda for political, social and cultural reasons. These groups would include, for example, women, the aged, ethnic minorities, the disabled and so on. In the context of this research project, social needs are those relevant to public sector service provision. The difficulties of the application of the concept to a public-sector technology policy will be discussed in Chapter Two. Here, the concern is to investigate the relationship between technological innovation and social needs.

Dosi (1982) defines needs;

'.... at one extreme, one may define them in very general anthropological terms (the need to eat, have shelter, communicate etc.) but then they express a total indifference to the way they are satisfied and do not have any economic relevance; or at the other extreme, needs are expressed in relation to the specific means of their satisfaction, but then each cannot emerge before the basic invention to which it is related (Dosi 1982 p.149)

The implication of this argument is that one cannot express a need for a product that does not already exist, for example, one could not express a need for a car until cars existed as part of a transport system. Taken to extremes this suggests that because the array of products on offer via the market mechanism represents to a greater or lesser extent the host of products available then essentially market needs are satisfied. In the context of a discussion of the market mechanism needs refer to economically defined demands. What this means is that an individual may have the need for a particular specification of wheelchair, but if he/she does not have access to economic resources with which to pay for it then the need will remain unmet. This lends support to the fact that the needs of a variety of sections of the community have not been satisfied or have been badly catered for, for example in the area of housing and health care. The conclusion reached is that the existence of social needs does not necessarily lead to the production of the means to meet those needs.

In the previous discussion of technological innovation it was found that various economic, political and social factors act as a spur to innovative activity. What is required is the commitment of resources either by industry or government. A commitment that is, usually, based on the anticipated economic benefit of the fulfilment of some need, whether it be, for example, a market or a military need. Within this scenario if a need is expressed by producer or user groups who do not have the economic or political power to allocate resources to it, then their influence on the innovation process is confined to political campaigning and pressure group activity. For example, the Lucas workers' campaign for the implementation of the socially-useful products developed as part of the Lucas Plan (see Wainwright and Elliott 1982).

The allocation of resources to basic research affects the route of technological development. From a number of technological options available for any given solution, innovation will depend on selection and priority. The concept of 'technological paradigm' (Dosi 1982) is useful in this context because it denotes an 'outlook' or 'model' which guides decision-making, for example, high-technology can be said to be the dominant bias in the present government's technological agenda (see 1.8). The exclusion effect of technological paradigms as developed by Dosi is akin to the exercise of power; the prevention of the very existence of alternatives (Lukes 1974).

Further selection devices for technological paradigms within capitalist economies are what Nelson and Winter (1977) term 'natural trajectories toward mechanisation and exploitation of economies of scale'. The current application of microelectronics and robotics to production processes can be seen to reflect this trajectory.

In sum, powerful economic and political factors act as selectors of technological paradigms. In this way the general direction of technological development is defined. The strong influence of a concept of progress delimits the technological trajectories within the overall paradigm (Dosi 1982). Once established the route of technological development can appear to display a momentum of its own within the context of the market. The discussion of induced innovation is relevant here as it demonstrates the 'knock-on' effect of innovations in industrial sectors.

Patterns of industrial and social conflict also act to select innovations. Analysis in this area may be fruitful for the discovery of relationships between technological choice and social factors. Noble's (1979) study of numerically controlled machine tools shows how automation can be chosen over other forms of technological development for reasons of management control. This study is discussed more fully in Chapter Two.

This discussion of the relationship between technological innovation and social needs reveals that there is little chance for certain sections of the population to influence the innovation process. This recognition led to the development of a political/technological project by the Greater London Council based on socially-useful products (Cooley 1984). The commitment to socially-useful products and alternative technologies provided a means to first, relate technology to social need through products such as aids for the disabled and so on. Second to present an alternative and prefigurative technological paradigm that could illustrate a different role for technology in society. Of major importance to this was the ability to influence, in some way, the direction of technological advance and the benefits that flow from it. To do this it was necessary to produce both a critique of the current shape and aims of existing technology together with examples of alternatives that could lead to social and technological change. This initiative forms the research project.

1.11 CONCLUSION.

Economic approaches to the study of the innovation process are concerned to reveal the factors necessary to 'successful' innovative activity. The criteria used to measure 'successful' innovations are economic indicators of profitability and market share. It has been argued that economic, and ideological, influences act as the dominant 'selection' factors for the support for innovative activity. In contrast to, for example, user needs as the primary consideration and measure of successful innovations. Of course the successful match between technological capability and user needs channelled through the market mechanism is central if innovations are to be successful commercially. Thus it is not to argue that technology does not reflect market needs. Rather the argument draws attention to the technological environment whereby social needs, not channelled through the market into demands, can be overlooked.

The use of the concept of technological paradigm (Dosi 1982), although impressionistic and difficult to analyse emprirically, provides an explanatory tool for understanding the nature and direction of technological development.

Patterns of innovation indicate that the paths of technological development are selected. The discussion of government intervention highlights the role of political processes in the selection of technological areas to support. In Britain this has taken the form of particular sectors of 'high-technology' development. The allocation of resources to R&D in these industrial sectors is based on their perceived economic importance.

The identification of technical change with economic growth acts a powerful argument in support of chosen patterns of development. Technological and economic determinism present the selection process as 'objective' and neutral, rather than political and always the result of decision-making at the very earliest stages of technological development. Perceived economic (or prestige) importance is seen as the reason why certain technologies emerge instead of others. (The social and political factors that affect the emergence of certain technologies instead of others are discussed in Chapter Two).

Technology-push approaches to the explanation of the innovation process are useful for understanding 'radical' innovations. Innovations advance cumulatively along technological trajectories in response to demand factors, within overall paradigms of development. Distinctive of developments within the innovation process throughout this

century are the growth of specialised knowledge and the institutionalisation of R&D in industrial and government laboratories. The innovation process is increasingly privatised and dominated by scientific and technical experts whose vision is focused on selected technological problems and solutions (Dosi 1982). Langrish et al (1972) note that this is the main way that science affects technology, the shared experience and expertise of scientists and technologists. Experts become blind to alternative technological possibilities.
In the allocation of resources to basic science, government plays a central role. In certain sectors, such as defence, government supports research and product development and also provides a market. This economic system is akin to that advocated by the notion of production for social need discussed in Chapter Two as a means of maintaining a direct link between technology and needs. The main difference, of course, is that defence technologies are replaced by alternative socially-useful technologies.

Market-pull explanations of the innovation process are useful for understanding incremental innovations. Radical innovations account for only a relatively small part of innovative activity, most innovations proceed through a life-cycle of some major, but mostly minor improvements. Theoretically innovations are influenced by user needs and economic demand but also may be 'induced' by a variety of economic, social and political factors.

For many sections of the population any influence on the innovation process is only indirect. Within the consumer goods market selection is among a range of goods already determined by broad technology patterns on the supply side. Consumers do not have the ability to influence the future array of goods, they choose between the existing array of goods on offer. In the capital goods market the 'needs' of efficiency and cost reduction of products are reflected by automated manufacturing processes. The ability of labour to influence the technologiy is ex-post, influence is possible at the implementation stage through adjustments to work organisation but the technology itself is already designed and developed, thus influence is within the constraints of the hardware..

Models of the innovation process are essentially prescriptive and designed to facilitate more innovation. The breakdown of models of innovation into stages aids an understanding of the coincidence of crucial factors to innovation. In addition models are useful analytic tools; they make it possible to identify the social groups present or absent from each phase of the innovation process. The context for much of the research on technological innovation is oriented towards the identification of the technical and organisational factors relating to commercially successful product or process innovation. The causal relationship between innovation and economic growth acts as a powerful justificatory argument for 'more innovation' and increasingly sophisticated technologies to ensure competitiveness in world markets. The adoption of competitive commercial criteria results in the selection of specific routes for technological development. This serves to exclude and obscure other potential paths of technological development.

The focus on the economic/ideological function of technology and its realisation within products and processes, provides a limited explanation of the nature and role of technology in society. In this view, the potential social impacts and unforeseen side-effects of technological innovations are a separate issue, the inevitable costs of the technological project. Yet the social implications of technological change comprise the larger context of technology in society. In Chapter Two sociological analyses of technology are discussed.

CHAPTER TWO: THE SOCIAL PROCESS OF INNOVATION.

2.1 INTRODUCTION.

A clear point which emerges from the discussion of the innovation process in Chapter One is that technologies are not politically neutral nor is their development wholly autonomous. The realisation that factors other than the market shape the allocation of scientific and technological resources is not new; in 1974 Brooks et al. noted:

'The capability of governments to introduce new socially-oriented technologies, altering traditional lines of technological development, is often less restricted by objective factors, such as competitiveness on international markets than is commonly assumed'(p140).

In this chapter the question of why certain technologies emerge instead of others is addressed from a sociological perspective. Studies of technology from this perspective reflect two conceptual traditions in sociology; the sociology of scientific knowledge and the Marxist tradition. The former perspective is based on micro-level analyses of technology. The Marxist tradition is based on macro-level structural analyses of technologies. The aim of work in this field is investigation of the relationship between society and technology, in particular, the identification of the social factors which shape technological artefacts (for a review of case-studies see MacKenzie and Wajcman 1985).

A review of this literature yields insights into the social organisation of the innovation process, the social relations embodied in technological artefacts and the possibility of alternative solutions to technological problems. The practical application of some of these ideas in the technology policy based on social need formulated by the Greater London Council (GLC) is the subject of the case-study presented in the following chapters.

2.2 DEFINITIONS.

The sociological perspective widens the definition of technology to include the social context within which machinery is developed and used. Attention is drawn to:

1. The design or development context which includes all the decisions, materials, personnel, processes, and systems necessary to create tools and techniques from raw materials.

2. The user context which includes all the motivations, intentions, advantages, and adjustments called into play by the use of particular techniques or tools.

3. The environmental context that describes nonspecific physical surroundings in which a technology or tool is developed and used.

4. The cultural context which includes all the norms, values, myths, aspirations, laws, and interactions of the

society of which the tool or technique is a part (Bush 1983 p137)

Of these more is known about the design and development context of technology than any of the others. Winner argues that the concentration on the design and development context of technology results from a 'technological orthodoxy' whereby the assumption is made that 'technologies are neutral: they are simply tools that can be used one way or another; the benefit or harm they bring depends on how they are used' (Winner 1979 p76). This use/abuse model of technology is challenged by Winner and other commentators whose work will be reviewed in this chapter.

The definition of technology to include all of its contexts clearly illustrates the interactive nature of technology and society. Machines or tools are designed and manufactured by people in a social context; the use of machinery by people gives it its reason to be - what is a car without a driver, a production line without an operator. Technology is also knowledge in the form of the expertise needed for the design, use and maintenance of physical artefacts (Layton 1974).

Once it has been established that technology is dependent on a social context for its development and implementation then it becomes possible to ask how the social context affects technology. What sort of influences do social relationships have on the design, development and use of technologies?

Studies of technological innovation, diffusion and the transfer of technology have tended to treat technology as a 'black box'. A point made by Layton when he noted; 'What is needed is an understanding of technology from the inside, both as a body of knowledge and as a social system. Instead technology is often treated as a black box whose contents and behaviour may be assumed to be common knowledge'. (Layton 1977 p198). In recent years research has moved towards looking inside the 'black box' (Rosenberg 1982). One approach is the emerging 'sociology of technology'. Work in this area attempts to reveal the existence of alternative technological solutions to technological problems and then explain why certain solutions were chosen rather than others. The point is that if it is possible to demonstrate that a technological artefact has alternative possible routes of development that are equally viable then the belief that there is an immanent logic of technical development is questionable.

2.3 THE SCIENCE-TECHNOLOGY RELATIONSHIP.

The application of ethnomethodological research to technology is based on the assumption that science and technology are not fundamentally different entities, thus they can be treated in equivalent terms. The science-technology relationship is seen as interactive and it is possible to suggest that political, economic and social factors interact in the same way within the construction of science and the process of technological innovation (see Hughes 1986). This view is supported by work on technological innovation which suggests that science and technology are interdependent;

'Science and technology have become intermixed. Modern technology involves scientists who 'do' technology and technologists who function as scientists... (Layton 1977 p210).

Or as observed by Langrish et. al (1972);

'First, curiosity oriented science, practiced largely, in academic institutions, provides techniques of investigation. Second, it also provides people trained in using these techniques as well as in scientific ways of thought in general...'(p.40).

The logical extension of the belief that science is socially constructed to incorporate the idea that technology is also socially constructed is over-simplistic if it assumes that technology is the application of science. The science-technology relationship discussed earlier in terms of 'technology-push' emphasised the inadequacy of this approach to technology. Historical studies of technology have clearly illustrated that technology as applied science is a misnomer. Science can influence technology in the same way that previous advances in technology can affect and influence further technological developments.

If science and technology are seen as equivalent bodies of socially constructed culture, then the demarcation between them is also socially negotiated (Pinch 1986). The sociology of scientific knowledge approach to technology is based on the view that the machines, practices and skills of technology are suitable for treatment in terms of the active construction of a technical culture. For the purposes of sociological analysis the two areas are equivalent. Pinch (1986) notes that this is not to argue that there are no differences between them. Technology is a more heterogeneous activity which incorporates a number of different groups - engineers, designers, managers and so on thus there are practical problems for research. Fundamentally, however, the approach is possible because this does not represent any underlying analytical distinction.

The sociology of scientific knowledge is concerned with the epistemological status of scientific knowledge. Studies have concentrated on the construction of scientific

knowledge in the context of the laboratory and in investigations of scientific controversies, in an effort to explain the definition and legitimacy of scientific claims (for an introduction to the literature see Shapin 1982). These ethnomethodological studies of the process of construction of scientific knowledge reveal that the acceptability of science claims depends on the social context of their interpretation rather than particular technical or logical criteria. From this perspective, scientists are seen as primarily 'social actors' (Callon 1980) operating in a social context, who use their cultural and intellectual assumptions and location to interpret the validity of knowledge claims. The aim of these studies is an understanding of scientific culture and the practices and bodies of knowledge which define that culture. Findings suggest that scientific knowledge can be treated as a knowledge culture in the same way as the legal system and the world of art comprise distinctive knowledge cultures. The content of scientific knowledge is shown to be shaped, at any given time, by the wider social context.
The main point is that 'scientific facts' can differ between groups of scientists working in differing social environments with differing methodological perspectives. Thus, scientific research is not an 'objective' process of demystification of the natural world, rather it involves the attribution of meaning to physical phenomena. The physical world may act as a constraint but it does not determine the

outcome of research and scientific conclusions. It is necessary to understand the influence of the social and political worlds that affect the interpretation of the meaning of physical phenomena (For a discussion of these studies see Collins 1983, Knorr-Cetina and Mulkay 1982).

2.4 MICRO-LEVEL STUDIES OF TECHNOLOGY.

Empirical studies of technology, influenced by work on the sociology of scientific knowledge, have centred on the design/development process with historical accounts of technological development, work on technological controversy and technological testing, and work on the application of scientific paradigms (Kuhn 1969) to technology.

Within the sociology of scientific knowledge the principle of symmetry is introduced to indicate that there is no epistemological distinction between beliefs that are held to be true and beliefs that are held to be false (Bloor 1976). The symmetrical approach to the development of technological artefacts is demonstrated by Pinch and Bijker (1984). The identification of alternative solutions to the design of technological artefacts allows analysis of both 'successes' and 'failures' so that the question as to why certain designs are selected and commercially developed whilst others are marginalised can be addressed. Without an approach which investigates the content of technological innovations, the technological artefact appears to go through a sequential process of research, development, production to usage in an unproblematic way. The possibilities of alternative designs and so on remain obscured (Pinch and Bijker 1984).

In their study of the development of the safety bicycle Pinch and Bijker (1984), found that at each stage of the development process there were a number of design options open. The basic 'Ordinary' or penny-farthing was modified to produce a range of extraordinary 'safety ordinaries' such as the Xtraordinary (1878), the Facile (1879) and the Club Safety (1885). In general, historical accounts only refer to these forms in passing. Bijker (discussed in Pinch 1986) argues that this is a product of retrospective interpretation. The Safety bicycle was commercially successful and linear retrospective accounts discount the variations because of this, yet some of these variations were produced commercially at the time. Reliance on a linear sequential model of innovation obscures the multiple paths and options which exist in the development of new technologies. Pinch and Bijker (1984) emphasise the importance of symmetrical accounts of technological development. They describe the developmental process for technological artefacts as evolutionary or as a pattern of variation and selection. An attempt is made to present a multi-directional model of the innovation process which demonstrates that the successful stages in the development of an artefact are not the only possible ones (Pinch and Bijker 1984 p.411). Bruce (1984) demonstrates the same point with reference to videotex.

The main question which emerges from these accounts is why, if innovation at some point was multi-directional, did some forms of artefact survive whilst others did not. To answer this question of selection Pinch and Bijker (1984) introduce the concept of 'social group'. They state that;

'a problem is only defined as such, when there is a social group for which it constitutes a problem' (p414).

The concept of social group is used to define institutions and organisations as well as organised or unorganised individuals. The key factor is the shared set of meanings attached to the specific artefact by members of the group. The identification of different social groups involved with the design and development process shows how the interpretations of the problems and possible solutions differ among these social groups. The ensuing conflicts, and their eventual resolution, are the mechanisms used to explain why the technology emerged in the way that it did. For example, differing technical requirements for speed and safety may be attributed to pressures from opposing groups which affect the final solution or design. The developmental process is seen as consisting of progressive degrees of stabilisation over a period of years - the Safety Bicycle came to be seen as the way to design a bicycle after a period of nineteen years, during which time other forms of bi- and tri-cycles competed for selection.

The aim of Pinch and Bijker's (1984) study was to reveal and explain how the technical make-up of a physical artefact emerged as the dominant design. Or, how one specific form is selected from the various designs present within the design and development process. Technical facts are found to be negotiable.

Studies of the content and development of technologies have been matched by studies of technological controversy. Technological controversy highlights the community of technologists, other actors, and competing firms who influence 'successful' innovations. In a case-study of the post World War Two effort of the French state to promote an electric vehicle, Callon (1980) uses the concept of 'actors' interacting and negotiating around a variety of social, economic and technical factors to explain technical development. Actors include the diverse groups of people who influence the development of the technology; technologists, scientists, manufacturers, government departments and so on. There are no rigid distinctions between the social, political and technological; rather what is important is the assignment of roles in a scenario or programme developed by the Electricite de France to fulfill its objective of designing an electric vehicle. Actors need to interact harmoniously as a precondition for the innovation of the artefact. The scenario 'actor-world' necessary for effective innovation is not constant but changes and at times breaks down. The case-study points to the way that the technical is socially constructed. Callon notes that certain innovations display;

1. considerable variety in the technological options that are available, and close links between technical choices and socio-political choices.

2. considerable diversity in points of view put forward by the numerous social groups involved.

3. an initial lack of determination of the market demand, which is built up at the same time as the equipment designed to meet it.

The study looks at the practices of powerful interest groups and their relation to other groups and the state. Powerful interest groups emerge as political actors who, by fighting to impose their technical choices effectively define the needs to be satisfied, the forms of social organisation to promote, and the action to be undertaken.

Pinch (1986) argues that what is unclear about this approach is whether it is actors who define forces as economic, natural or social or whether it is the analyst who has some a priori method for determining the various components. Despite methodological difficulties studies of technological controversy highlight the close relationship between technological development and economic and political power. Power is central not only to the selection of technologies but also the definition of the technical superiority and workability of technologies.

Within the sociology of scientific knowledge approach to studies of technology the emphasis is on workability; how technologists and engineers actually go about deciding whether or not a technology works and how it is to be tested (Pinch and Bijker 1986 p.351). Workability is also important to studies of the history of technology. MacKenzie in a study of ballistic missiles showed how technological testing, and the wider social and political credibility of that testing were crucial to determining facts about missiles - such as whether they work or how accurate they are (MacKenzie 1986). In the study MacKenzie points to political and organisational interests that are reflected in the design process of Trident or MX ballistic missiles, and further in the interpretations placed on the test results of these missiles.
The notion of scientific paradigm (Kuhn 1969) as applied to technology was discussed in Chapter One. Its main proponents are Johnston (1972) and Dosi (1982). However, application of the concept of paradigm to technology as an

analytic tool has been criticised as overly mechanistic. Pinch (1986) notes that its usage in this way fails to take into account that paradigms are not fixed sets of rules, rather they refer to the interpretation of rules in localised concrete settings. A point supported by MacKenzie and Wajcman (1985) when they note that 'the technological paradigm is not fixed but acts as a resource that can be used' (p.11). Thus, technological paradigms and trajectories of development within them are social constructions closely related to the social context in which innovations are attempted. The notion of technological paradigm interpreted in this way provides a way of understanding how traditions and bodies of knowledge and practice shared by particular groups can shape technological development. Further, Pinch (1986) argues that it provides a way of comparing different developments in different technologies at different times.

In Chapter One the notion of reverse salients within a technological system (Hughes 1983) and induced innovation (Rosenberg 1976) indicated that innovation proceeded by way of a domino effect. Once an innovation had been introduced in a certain part of a technological system then other areas would also require innovative activity. Work on the implementation of new technologies looks at the problems that companies face in getting technologies to work (Fleck 1983, Voss 1985). Pinch (1986) sums up with this approach when he notes;

'tinkering towards success may be the way this process proceeds, not because of any fundamental inadequacies in machine operation or in management techniques but because a key component of technological knowledge is the solution to localised problems in an ad hoc way'.

Whilst it may be possible to identify methodological and conceptual weaknesses in the studies discussed above. The criticisms that have been made by commentators (in particular, Russell and Williams 1987) have concentrated on the inability of these studies to reconcile 'context and action'. Russell and Williams question the pluralist view of power upheld by such studies. The studies cannot deal with the issue of power in the sense of how this structures not only actors perceptions of the technological decision-making process and agenda of debate but whether technological issues are even seen as something that can be actively influenced. This criticism is based on Lukes (1974) notion of a three-dimensional view of power. For example, in Callon's (1980) study attention is not paid to events before innovative activity which brought the powerful interest groups into the technological arena in the first place. Although disagreements within the state and between the numerous social groups involved in the debate are mentioned, Callon focuses on the direct negotiations between these actors, and consequently underplays the ways in which the massive pre-existing interests of industries and groups whose future was closely linked to the petrol driven car, such as the motor industry and the oil industry, created the terrain on which the subsequent struggle took place. A terrain which ensured that the electric car only had marginal support (Russell and Williams 1987).

The focus in these studies on observable events needs to be matched by macro-analyses that can deal with the structural use of power. Events need to be firmly located in their economic and political context. Russell and Williams (1987) argue that this would allow key questions to be addressed such as; How do dominant technological and policy paradigms become entrenched, whilst others are marginalised. Analysis at this level requires attention to the institutional context within which innovative activity takes place. For example, the differential constraints and resources accessible to actors. The composition of actor groups and their interests and so on.

The concentration on the social processes of innovation highlights the differing abilities of social groups to influence the design, development and adoption of technologies, but this requires explanation. The relation between the technological determinist stance and issues and debates of power is an important one because without some analysis the ability of social groups to influence the innovation process is not challenged. The problem of social choice exerted by interest groups is not discussed. Selection implies a consensus but a consensus among whom? Who decides which variations of artefact constitute the choice in the first instance? How is progress or success defined (see Russell 1986).

What these criticisms point to is that outcomes are not infinitely flexible. There is a need to recognise the specific constraints and possibilities for change at different levels. Russell and Williams (1987) argue that an interactive model of the relation between context and action is the key to overcoming the separation of micro and macro approaches to understanding technology as a social product.

The technology studies discussed in this section draw attention to the complexity of events surrounding particular technological developments. Findings reveal the multiple influences, multidirectional character and the potential flexibility of outcomes for technological design/development. What is accepted as technically determined and what can be seen as socially-constructed constraints on choice are questionned. The technical detail however does require a thorough grounding in social context if the relationship between technology and society is to be clearly understood. The conclusion that technologies embody social and political relations and how this occurs is important, however, why this occurs is not fully confronted in these studies.

2.5 THE MARXIST APPROACH TO TECHNOLOGY.

The question of why technologies are designed to certain specifications and not others has been addressed by Winner in an article 'Do Artefacts Have Politics (reprinted in MacKenzie and Wajcman 1985). He argues that technology is inherently political; designed consciously or unconsciously to open certain social options and close others. In other words, technological artefacts embody conscious social choice for desired effects. This analysis of technological development looks to its utility to reveal certain influences that affected the design of the technology. Influences that are missed if the technology is discussed only in its design/development context.

Winner gives the example of the building works of Robert Moses, in particular, the bridges over the parkways on Long Island, New York. He argues that the bridges were built to specifications which precluded the use of buses. An effect of this was to limit the access of racial minorities and low-income groups to Jones Beach public park. These groups were predominantly not car owners and therefore relied on public transportation. What this study reveals is that in order to understand the choice of certain forms of technology as opposed to others it is necessary to locate technology in the user context. That is, how it operates in the real world which displays an unequal distribution of resources and power in society.

The Marxist approach to the study of technology is based on the interactions between economy, society and technology. Within this perspective, technological change cannot be understood by reference to individual inventors or particular innovations. Rather it is necessary to examine how larger social and economic forces affect the focus of technological problems that require solutions. Usher perceives this as the question: 'how is the stage set to suggest the solution of the perceived problem?' (cited in Rosenberg 1982 p.49).

The Marxist analysis of science and technology has concentrated in some depth on the labour process, in particular, the nature of capitalist control of the labour process. Much research on the labour process was stimulated by the analysis of technology in capitalist society developed by Braverman in 'Labor and Monopoly Capital'(1974). The central concepts in this analysis are 'de-skilling' and 'taylorisation'. These concepts refer to the use of scientific management principles. First, to dissociate the labour process from the skills of workers, second, to separate conception from execution, and third, to use the resulting monopoly of knowledge to control each step of the labour process and its execution. The process of 'taylorisation' was not seen as resulting from technological change, for example, the automation of the production process. In this analysis the technology was seen as neutral. Taylorisation represented a form of implementation of technology that ensured capitalist control.

The extensive research which followed Braverman's analysis found that 'de-skilling' and 'homogenisation' are tendencies of the implementation of technology in capitalist societies but that implementation is affected by other factors apart from capitalist control (see Wood 1982). Several studies point to worker resistance as an important factor in the technological transformation of the labour process (Burawoy 1978, Elbaum et al 1979). Further that the relationship between technology and skill requirements is affected by local conditions and wider economic and political factors (Wood 1982). A conclusion which emerges from this work is that the straightforward use of technology by capitalists to control workers is over simplistic and ignores other mediating factors which influence innovation and technological change.

Elbaum et al.(1979) point to the way that competition acts as a constraint on the capitalist use of technology for the control of workers. In addition, the choice for managers when adopting new technologies from the available alternatives on offer involves a process of political negotiation between management and workers. The choice of available technologies also acts as a constraint. Certain forms of work organisation are already dictated by the use of the technology (see Rose et al 1986). Wilkinson (1983) argues that technological choice and the establishment of working practices are negotiable, and not the outcome of a system beyond the control of interest groups. He argues that the mode of implementation of technologies and subsequent 'debugging' processes offer opportunities for actors to influence the process of technical change and innovation in the diffusion and adoption phase of a new technology. From this perspective the ability of groups of workers to influence the technology is post hoc.

What is unclear in the labour process analysis of technology is the issue of the social shaping of technology. Are social relations embedded in technology or do social relations affect the application of technology? The question as to whether the design/development of machinery reflects the social relations of its conception is left wide open.

Other research in the Marxist tradition has addressed this question. In a study of numerically controlled (NC) and computer numerically controlled (CNC) machine tools, Noble (1979) illustrates the complexity of forces that affect the design of this technology. He argues that technologies of production, in their design and in the context of use reflect management/employee relations and the realities of shop-floor struggle between classes.

The aim of Noble's study was to discover why the technology took the form that it did. The problem of automating contour machining offered two solutions: record playback and N/C. According to Noble, the difference between these two solutions rested on the amount of control over workers' skill that was offered by the technology. The design of N/C machine tools did not simply reflect productivity gains. Another factor was the political objectives of employers; the transference of responsibility and control over machining techniques from the craft machinist to the programmer. Noble examined the development of this technology and the suppression of alternatives, such as record playback. He uses the case-study as evidence of a managerial control strategy.

Record playback as a technological option in the design/development process obtained task repeatability whilst leaving the intelligence of production in the hands of the machinist who made the tape. N/C, in contrast, was a technology designed to accommodate the breakdown of machining into numerous separate tasks. Thus, the intelligence of production was built into the machinery and the skill of the machinist was replaced.

In the study Noble demonstrates the link between technological choice and the predominance of military and aerospace sectors in the development of the technology. During its development N/C received substantial military support. Its cost meant that only large companies, often in receipt of government contracts, were able to adopt the technology. The ideological factor was also important in its adoption; N/C as symbolic of the computer age. If economic considerations had pre-dominated then record playback was suitable for most machining needs, whilst not involving the huge investment in computing and progranmming necessary for N/C.

The social relations of production also played a key role in decisions to develop N/C. Noble gives the example of General Electric. It was one of the first companies to adopt record playback, but after a series of strikes during the 1940's, machining was automated using N/C. The reasons for the shift in design effort are illustrated by the following quote from an engineer involved;

'Look, with record playback, the control of the machine remains with the machinist - control of feeds, speeds, number of cuts, output: with N(umerical C(ontrol) there is a shift of control to management. Management is no longer dependent upon the operator and can thus optimise the use of their machines. With N/C, control over the process is placed firmly in the hands of management - and why shouldn't we have it? (Noble 1979 p.34).

However, the issue of control is not the whole story. Despite these attempts at control, management still needed experienced machinists to ensure that 'automatic' machines worked smoothly and produced components of good quality. Noble's research indicated the complexity of forces that influence technological design/development. He showed that automation did not have to proceed in the way that it did and that choices other than the purely technical or economic affect the design/development of technologies. However, the subsequent development of this technology exhibited contradictory tendencies that could not be readily explained in terms of interactions between social actors. There was a need to consider social and economic forces once or twice removed from the technology itself. For example, changes in the price and capability of microelectronic technology and changes in the composition of users of the machine tool. Noble noted that the rapidly falling cost of memory and computing power facilitated the development of CNC machine tools in which programming equipment was attached to the machine tool. This made it technically feasible and possibly economically attractive to institute shop-floor programming of machine tools. In effect, this opened up opportunities for craft workers to retain or regain control over programming. He notes that CNC was potentially subversive to the division of labour established under NC machines. Whereas craft workers put up relatively little resistance to technician programming of NC machine tools, responsibility for programming CNC has been fiercely contested between machinists and technicians in many engineering factories in the UK (Russell and Williams 1987).

Over-reliance on the explanation of control in Noble's study has been questionned by Wajcman (1986). She argues that it is uncertain whether Noble's account deals adequately with the possibility that, in the long run, numerical control was favoured for cost and profit reasons rather than for control over labour as such. Noble acknowledges in his epilogue that it is impossible for a firm to know when it has found the technique of production that produces maximum profits - the measurement of performance is by its very nature ambiguous and imprecise. Noble concludes from this that economic calculations often seem primarily to be used to legitimate decisions already taken, rather than as the rational basis for decision-making. However, Wajcman (1986) argues that a parallel argument could be made for management's goal of domination. How do they know which technique will, when operational, actually secure their control? She concludes that a simplistic domination theory of technological change is hardly more satisfying than a simplistic 'profit maximising' one.

In Chapter One the evolutionary nature of much technological change was discussed. Rose et al.(1986) argue that concentration on the social factors which shape technology can marginalise the influence of the technology itself. Social factors are not the whole story and as an alternative to technological determinist models of the relations between technology and work are inadequate. Whilst these commentators acknowledge that it is one thing to say that technology is not the primary determinant of work organisation, they are critical of studies which downgrade the influence of technology as a force amongst a complexity of other forces. Rose et al. base their arguments on findings from a study of the process of change involved in the modernisation of a small sample of local telephone exchanges in British Telecom. Their analysis is based on how far the two types of exchange technology were associated with specific kinds of maintenance tasks and skills; and how far the technology determined forms of work organisation. Findings of the study indicated that the tasks and skills required to operate and maintain the exchange technology were strongly influenced by its form. However the distribution of tasks and skills into particular jobs and the location of jobs in the occupational structure were less dependent on the technology. They argue that the way that jobs were organised was strongly influenced by social factors although the choices that were made were both enabled and constrained by the nature of the exchange technology.

Rose et al (1986) propose that within social shaping of technology arguments, an analysis of the role played by technology as a discrete independent variable should be incorporated. They argue that there is a strong case for examining the way that technology and social variables interact at the design stage as well as at the workplace level.

The complexity involved in identifying discrete variables in analyses of technology is evident in many studies. They indicate that the social factors affecting technological development are complex and interactive amongst social classes, gender groups, economic and political factors. Wilkinson (1983) notes:

'the design and choice of technology may be seen as the result of socially-derived decisions, and the way in which technology is used can be explained in terms of political processes. (p.20)

Lazonick's (1979) account of the development of the self-acting mule in the spinning industry shows how adult mule-minders in Britain retained their positions of power not because of resistance but because employers found the hierarchical division of the workforce between minders and piecers useful. In this way differential relations among the workforce affected technical development.

In a study of the US garment industry Schwartz-Cowan (1979) argued that the sewing process had not been automated because of the cheapness and availability of immigrant women workers. Gender and class relations affect technical change. A point reinforced by Cockburn (1981) in a study of typesetting technology in Britain. She shows that the choice between alternative designs of mechanised typesetting was based on the preservation of male domination in the composing room. This is indicated by a a statement made by the male-dominated union; the London Society of Compositors; (by not splitting the typesetting process);

' ...the Linotype answers to one of the essential conditions of trade unionism, in that it does not depend for its success on the employment of boy or girl labour' (Cockburn 1981 p.46).

The deskilling and potentially feminising quality of the technology was not achieved because of compromises between capital and skilled labour in the industry. Cockburn argues that her analysis highlights the role of patriarchy in technological design/development. Again, a finding uncovered by a concentration on the technology from the context of the user.

The effect of capitalist relations on technologies was the subject of a study of domestic technology (Schwartz-Cowan 1983). The domination of electric refrigerators over gas refrigerators was shown to result, not from technical superiority or consumer preferences but differences in expected economic returns.

This empirical work suggests that the influence of social factors on the shaping and choices of routes of technological development are embedded in technologies themselves. The identification of alternative possible routes of development that were neglected for social, political or economic reasons highlight the way that the nature of technology is inextricably linked to its social context. The key point is that the understanding of the effects of social relations on technologies requires not only the investigation of the design and development of physical artefacts but also their role in the context of use/implementation. It is not sufficient to argue that technology is neutral and its application reflects social relations, rather the evidence of alternative paths of technical development point to the importance of selection and choice of technological design by social and political groups with the economic and political power to choose.

2.6 IMPLICATIONS FOR THE INNOVATION PROCESS

To summarise the social shaping of technology argument, Johnson writes;

'... the shaping of technology is a social process from selection of research projects and market targets, to the form of its introduction, degree of adaptation required by the economy and society into which it is introduced - and ultimately to the values and goals of an industrial society. These social processes and ... these interactions are responsible for the ways in which technology augments and limits human capability' (Johnson 1985 p381).

The unequal distribution of power and resources in capitalist societies ensures a differential access to the innovation process. In Chapter One the selection environment for technological development was discussed. The studies reviewed in the previous sections indicate that technologies embody a multiplicity of forces which, consciously or unconsciously, affect its design. Forces that include the interests of powerful groups, defence and military requirements, political processes between interest groups, differential relations among a workforce, localised problems within a technological system, gender and class relations, capitalist relations, patriarchy and elements of the evolution of the technology itself. All of this work points to the close relationship between technology and the cultural norms and values of the society which makes it. Without doubt, technology represents a problem, in particular for those groups in society who do not have access to the innovation process, apart from in a very indirect way. A point supported by Wynne when he notes that;

' ... the present social organisation of innovation and design is dominated by technical experts oriented towards specific priorities' (1983 p.16).

The labour process theorists point to the way that workers mediate and affect the implementation of technologies. In the present organisation of the innovation process this influence is typically post hoc, that is, after technologies have already been designed and developed. In Chapter One the importance of the interaction between science, technology and the market was discussed in terms of prerequisites for 'successful' innovations.

The relationship between innovation activity and user need was found to be important. In the economic approach to the study of innovations the saleability and therefore 'success' of technological innovations depends on how reflective they are of the needs of the user. However, the current social organisation of the innovation process means that the needs of the user do not have a direct input into the innovation process - rather needs are fed back to producers through the market mechanism.
The technological environment in capitalist economies is geared towards economic growth. Questions such as, whose interests will this technology serve? Who will reap the

benefits and who will carry the costs of this technology are not asked.

The workability of technological innovations clearly depends on the social context of implementation - technology works because people operate it, maintain it and so on. The view that technology does not reflect needs (see 1.10) was based on the appropriateness or otherwise of technologies in the user context. For example, lead in petrol may not be viable in terms of the social costs of pollution. The concentration on technological innovations as physical artefacts serves to obscure their dependence on the context of use (Bush 1983).

Wynne (1983) argues that the 'machine' approach to the understanding of innovation splits technology from implementation so that products and processes are designed and developed within the confines of the innovation process. Implementation/use is an external factor. One effect of this is that the privatisation of the innovation process and its domination by 'technical experts' involved in their own goals and priorities within the paradigms of certain problem formulations and solutions. The complex realities of the implementation stage of the innovation process are neglected by 'experts' when choices are made between alternative designs and strategies. The privatisation and increasing specialisation of the innovation process means that 'experts' (usually male) are increasingly socially isolated from the realities of the social system of technology - they operate with technical or machine conceptions of technology. The needs of women and other groups often remain unrecognised, these arguments are developed within feminist analyses of technology. Zimmerman notes:

' From the preliminary conceptualisation to the final marketing of a product, most decision-making about technology is done by men who design, usually subconsciously, a model of the physical world in which they would like to live, using material artefacts which meet the needs of the people - men - they best know. The result (is) technological development based on particular sets of male conditioning, values and roles...' (Zimmerman 1981 p2).

In sum, the needs of various socio-economic and culturally-defined groups remain unmet by the current process of design and innovation. Neglected also by the 'decision-makers' who make the crucial choices between alternative solutions to social/technological problems. (see Bruce, Kirkup and Thomas 1984, Bruce 1985).

Empirical research demonstrates the problems that the social isolation of 'experts' from users and the split between innovation and implementation/use can give rise to. In the area of computing it has been noted that:

'Systems can be ineffective when they are not well understood by people who use them, provide inaccurate data, demand unusual precision and attention, or are difficult to modify when the kinds of information users want changes. These difficulties can undermine the utility of the computer system even when its users are relatively homogeneous and welcome computational assistance' (cited in Wynne 1983 p20)

Computing system design concentrates on the technical aspects and coding, the user interface is usually the last part to be designed, though this is changing as companies face increasing competitiveness and user friendliness is seen to be a major factor for sales. In a study of computer specialists, Weizenbaum (1976) notes that although it may appear that they are open to influence by user needs of design, often specialists have rather low opinions of users and tend to use their own perceptions of user needs when designing and developing systems. For many groups of workers, user input into computer software packages is marginal; administrative workers and librarians complained of this at a conference workshop on human centred technology held at Aston University in 1986.

These examples point to the problems for designers and innovators of understanding the social realities of the user context. The area of computing provides a contemporary example but there are many others. The lack of involvement by users in design and innovation means that often technologists reflect 'needs' as perceived by experts, or their own knowledge, rather than the needs of the client or the user. There are many examples (see Lawless 1977) where the viability of a particular innovation may require resources or expertise or particular cultural patterns that do not exist. This is apparent in many cases of technology transfer from the West to underdeveloped countries.

There is an argument here for the encouragement of indigenous research and development based in the local culture and economy and able to be realistic to the resources, possibilities and needs of the local population. The case-study of the GLC technology policy presented in the following chapters is an attempt to approach technological development in this way.

The social context of use of technology is an essential part of the innovation process. In Chapter One, the model of the innovation process illustrated by the 'innovation spiral' pointed to the way that re-adaptation comprises an integral part of the innovation process. That is, incremental innovations of products and processes are dependent on feedback from information gained from use.

If technological innovation is seen as a continual learning process then 'learning by using' (Arrow 1962) is as important a component of the innovation process as the learning involved in research, design and development or producing new scientific knowledge. In a study of the capital goods sector product differentiation may be driven by learning by using; often the users themselves make important modifications that will be part of the specifications of later models. The capital goods sector operates on a close relationship between producers and users, where purchasers have a more direct input into design specifications. This was the case with clinical analysers (Von Hippel and Finkelstein 1978). It has been shown that models which have proved more amenable to user modifications have ultimately been more successful commercially. In this way learning by using creates new information that feeds into the design process of new product development, eventually resulting in modifications to the hardware.

Design flexibility or the production of hardware that can cope with future changes and modifications and accommodate learning by using appears to be characteristic of high technology industries where system complexity is an integral part of the product or process (Rosenberg 1982). Computing and software design provide a good example where companies are reliant on user modification in order to achieve the optimal design characteristics of software packages.

The recognition of the importance of learning by using is acknowledgement of the importance of the social system of technology for the innovation process. However the capital goods market is more homogeneous and lend itself to learning by using. The consumer goods market is heterogeeous and highly competitive so that learning by using is less likely. It is in this area that there is a need for design and development processes to be more open to interaction with users. If the innovation process is seen as a continuing cycle of design, development and use, participation by users may be acknowledged as an important factor in the continual feedback of knowledge that significantly affects the design and development stage of product and process development. The capital goods market can exhibit a close interaction between supplier and user, while the nature of the consumer market makes this more difficult. The alternative initiatives for innovation discussed in the case-study attempt to introduce a technology policy that is based on a close relationship between producers and users.

2.7 SOCIALLY-USEFUL PRODUCTION.

In his book 'Design for the Real World', Papanek (1974) called for a closer interaction between designers and users to ensure the workability of technologies in the real world. His argument for the design world put a voice to the political themes of participation and participatory democracy which emerged from student activism in the late 1960s and early 1970s.

As a proposition, 'participation' is based on the belief that people affected by design decisions should be involved in making those decisions. During the 1970s the idea of user participation in the design process gained ground. In product design it was based around the notion of 'design for need'; close relations between the designer and user were emphasised, particularly in relation to design for the disabled (see Langdon and Cross 1984). Another area where the concept was influential was within architecture and environmental design (Gibson 1986). A conference held in Manchester in 1972, on the theme of design participation, and where designers converged to discuss their ideas and views on user participation in the design process, was an event which demonstrated the interest in the area at that time (Cross 1972).

The concept of participation lacks clarity, thus it can be used to denote a number of activities that range from purely passive consultation exercises to active self-determination by users (Wulz 1986). This has been particularly evident in planning and environmental design when, following the Skeffington Report (1968), local authorities were urged to make provisions for participation in town planning. For some advocates, user participation refers to actual user decision-making power. For others, a transfer of power is not on the agenda; the professional domain remains the same and the user is required only to voice an opinion. In effect, participation in these instances refers only to a change of procedure within an unchanged balance of power (Habraken 1986). Many efforts at public participation were primarily centred around attempts to influence the design activities of experts; planners, designers and other professionals.

In terms of product design a substantially more participative approach emerged in 1976 with the Lucas Plan; an alternative corporate plan designed by groups of skilled workers at Lucas Aerospace (see Wainwright and Elliott 1982). The Plan was for a range of socially-useful products to be developed based on the idea of production for social need. The Lucas Plan will be discussed more fully in Chapter Five. It is important here as an example of participation in the product design process between producers and users on products directly related to social needs articulated by the community. Socially-useful production is the term used to refer to this form of innovation strategy. Mike Cooley; a leading member of the Lucas Aerospace Shop Stewards' Combine Committee and latterly Director of the Technology Division at the Greater London Enterprise Board (GLEB), defined socially-useful products as:

'..products that in their design, manufacture and use enhance human-skill and ingenuity, conserve energy and raw materials and aid human beings rather than control, de-skill or maim them. In addition, new forms of technology are supported which would provide for human-enhancing and liberating means of making socially-useful products - human-centred technologies' (Cooley 1984 p51).

The Lucas Plan demonstrated the possibility of an alternative social organisation of the innovation process.

A key point was the close connection between producers and users. This was achieved by a process of linking the skills and equipment and resources at Lucas Aerospace to social needs identified in the community via a form of 'popular planning'(see Chapter Five).

Socially-useful production implies a contrast to production for profit. To avoid ambiguity the concept is best reserved to cover those products which would not be produced under a capitalist market system because they require state involvement in research, development, distribution and purchase, such as, products relevant to basic service provision (Newman 1986). In a welfare economy, social needs such as housing, health, education and so on relate to collective service provision by both central and local government. The nature of the service provision is dependent on poliitical priorities and the commitment of resources. The Lucas workers hoped that the (then) Labour Government would switch funding resources from defence products to 'socially-useful' products. In the event, however, this was not to be. With the Lucas Plan a missing ingredient was markets and the finance to follow through with the development of products. Given the lack of state support, there was a need to match the product proposals with market opportunities. Socially-useful products in the form of medical technologies, transport technologies, aids for the disabled and so on are directly relevant to local authority statutory service provision. The local authority market appeared to provide an opportunity for socially-useful product development. In this way, the GLC technology policy discussed in the following chapters may be seen as a direct offspring of the Lucas Plan.

For the 'radical' local authorities, and the GLC in particular discussed in the case-study, the notion of alternative plans and production for social need became key components of their economic thinking (Benington 1986). The point of alternative plans is to present constructive alternatives to existing technologies. The commitment to socially-useful products provides, first, a means to link technology directly to social need through products such as aids for the disabled. And second, presents a picture of an alternative and prefigurative technological paradigm; a different role for technology in society. The innovation process was a key point of intervention in attempts to direct technology and the benefits that flow from it toward social and political objectives. The approach may be termed socially-directed innovation, and as such it was an overtly political programme.

A socially-directed organisation of the innovation process recognises the context of use as an integral part of the innovation process. The access of a range of social groups to the design/development stage of the innovation process;

both producers and users was an important pre-requisite. The GLC created the 'technology networks' to provide the facilities for this alternative approach to innovation. The aim was the use of resources; materials, energy, capital and labour, to meet social needs more effectively (see Chapter Six).

The application of the concept of social need to a public sector innovation/technology policy is not without its problems. Social needs may be defined as the needs of groups who do not have access to political and economic resources and the power with which to articulate and satisfy needs through the market - for example, the needs of women for increased child-care provision. Who defines needs, whose needs are more important than others are political questions. Differentiating between needs and wants, and the cultural relativity of needs highlights some of the problems of basing an innovation process on the satisfaction of social needs.

A political programme based on the provision of needs involves selection and priority. In the same way, support for certain innovations involves selection and priorities. Politically and socially directed innovation processes are seen as a way of prioritising certain needs, based on a broad remit of local authority service provision. Social needs that can be identified through popular planning processes and participation by users in the design/development of technologies.

Needs is a teleological concept in that it always assumes some end goal or purpose, that is, needs are inextricably linked to values. Obviously difficulties arise on how to define goals - is it a process of consensus, and among whom, or an explicit political programme? The GLC Economic Policy Group (EPG) acknowledged that;

'People have conflicting needs: sometimes because of different values and desires. An economic strategy based on social need would challenge the inequalities but it would seek to express and fulfill different values and desires' (Jobs For A Change, GLC 1983 p29).

This definition recognises the complexity of a social definition of need but the problem still remains of selection between needs, how to secure the articulation of need and who decides on priorities given the limited resources available.

Further, production for social use/need is a difficult area to define practically - the social usefulness of a technology is context dependent and it is perhaps easier to define what is not socially useful rather than what is. In terms of alternative technologies 'needs' are meaningful when there is some form of concrete possibility of realisation. For a programme of socially-directed innovation of alternative technologies problems exist in the sense that needs are related to the choices on offer, for example, radiation and chemotherapy are the choices on offer in the cure for cancer. This raises the question of how is it possible to secure the articulation of need without a range of choices being already available? What are the mechanisms for offering alternative technological solutions to problems? Once alternative technologies are developed, how is it possible to offer these to groups who do not have the economic resources to pay for them? Market needs are assumed to be articulated as economic demand - is there a way of meeting needs despite the financial constraints on the public sector? These questions, together issues of participation in the innovation process are addressed in the case-study which follows.

CHAPTER THREE: THE SETTING OF THE CASE-STUDY.

3.1 INTRODUCTION.

The discussion of technological innovation and the social factors that shape technological development drew attention to the possibility of an alternative approach to technology policy. An approach based on public participation in the product design/development process and directly linked to social need. The research presented is a case-study of such an approach formulated and implemented in the context of a local authority; the Greater London Council (GLC), whilst the Labour ty was in office between 1981 and 1986. To gain a deeper understanding of policy initiatives, and importantly, policy outcomes, it is necessary to locate them in their historical, political and economic context.

Conflict has characterised central and local government relations since 1979 and has revolved around central government attempts to control public spending. Thus during the 1980's local government has increasingly been at the forefront of political debate in Britain. The two main factors that have contributed to the increased tension between the centre and the locality are as follows. First, the Conservative Government's legislative changes that led to greater control over local authority spending in the form of rate-capping, and the abolition of the Metropolitan authorities, including the GLC, in 1986. Second, the renewed interest within the Labour Party in local government as an arena of political struggle and socialist advance. It is in the area of local economic development, as variously perceived by the Conservative Government and the radical Labour controlled authorities, that the breakdown of consensus between the centre and the locality can be most clearly illustrated. Attempts by the radical local authorities to demonstrate the importance of public sector institutions and organisations to the economy were in marked contrast to the central thrust of Conservative government policy; the encouragement of a shift away from municipal provision to market provision (Young 1986). These competing views on the future forms of social and economic change envisaged for Britain comprised the background to the economic, and technological, initiatives of the radical local authorities. It was a background of tension and conflict in the national political context.

This chapter sets the case-study in its national economic and political context. It looks at the nature of local economic development, the radical alternatives, and the legislative changes that most seriously affected local authorities during the 1980's. The discussion of central/local relations shows that open conflict between central and local government is not new, perhaps the most famous examples are Poplar in the 1920's and Clay Cross in the early 1970's (Cochrane 1983, Gyford 1985). The aim of the chapter is to illustrate not only what local authorities, and the GLC in particular, are doing but also why, and how the national context affects their position as agents of technological change.

The term 'radical' is used to describe the local authorities with a Labour Left majority who were concerned to introduce public sector-led industry and employment initiatives. It is acknowledged that there were many local authorities who developed radical policies at the local level, Liverpool immediately springs to mind, but in this thesis the term refers particularly to the Greater London Council (GLC), West Midlands County Council (WMCC) and Sheffield City Council.

3.2 THE LOCAL AUTHORITY.

Local government or the local authority (I tend to use the terms synonymously) in Britain is a political institution charged with the provision of local services in the form of education, housing, environmental health and so on. The functions and boundaries of local government are not fixed or laid down in a written constitution, they are negotiated through Parliament. Thus local government operates within a pre-defined framework erected during the course of historical developments (Cochrane 1983).

Essentially, local authority activity is legislated activity; legal, financial and ideological rules, regulations and assumptions act to ensure their possession of only limited economic and political power. The legality termed Ultra Vires further contains activity; a function can be performed only if there is a statutory power to do so. The existence of a statutory power is often a matter for the courts to decide. If it is found that a local authority has exceeded its power, the activity will be declared Ultra Vires and void or illegal. This point is exemplified by the House of Lords ruling that a supplementary rate issued by the GLC on London ratepayers; to raise monies for a grant subsidy to the London Transport Executive to finance the cost of a twenty-five per cent fare reduction, was Ultra Vires the provisions of the Transport (London) Act, 1969 (Rhodes 1984).

Local authorities are not only characterised by legal and financial constraints, their political and ideological position is equally important in relation to new policy departures and change. Political and ideological concerns about legal powers; the traditional means by which local authority legal officers restrict new policy departures, have been reinforced by the rise in the number of court cases instigated by both central and local government in recent years. Concern about legal powers, although based on legal grounds, includes an ideological stance. The restrictions on local authority independence from central government exist but allow a certain amount of room for responsiveness to local economic and social conditions. Often this room emerges as the result of the creative exploitation of their limited powers. Young (1986) argues that this type of exploitation is necessary to the process of domain expansion; the extension of local authority activity into new areas.

In relation to local economic development the political and ideological position of Council Members and Officers can be seen to have a direct bearing on forms of policy initiatives. The Royal Town Planning Institute Report of 1980 lists the following points in relation to the position of the local authority and its potential in economic development activities.

a) the general concern of local authorities for the economic well-being of their areas as a whole;

b) the importance of local authorities as employers in their own right;

c) their concern for the employment prospects of future populations;

d) their unique ability to put a local perspective to government industrial and employment policies, and their scope for politically modifying the local impact of these policies;

e) their role as planning authority, both in the preparation of statutory and other plans and in the control of development;

f) their ability to respond to major decisions affecting the local economy whether made by government or employers;

g) their ability to monitor the local situation and measure the effectiveness of initiatives taken;

h) their ability to create opportunities for investment, both by themselves in response to a market gap or by others;

i) their existing powers to provide infrastructure for industrial development and to assist firms financially (see Mawson 1981).

Despite this unique position held by the local authority, realisation of its potential will depend on the political and ideological orientation of the individual authority.

Some commentators relate forms of policy initiative to a general theoretical framework on the nature of local government. Cochrane (1983) characterises local authorities as problem-oriented bodies, thus an issue only comes to be seen as a problem if it is defined as such by the organisational members. Young et al. (1980) develop this point and argue that the people involved in the economic development process have the greatest significance for the definition of the problem and the formulation of policy. Individual perception and action is a useful means of explaining the different strategies produced by local authorities, it is akin to the idea of a 'product champion' in relation to technological innovation. In the discussion of the GLC initiative it is noted that the background and particular concerns of certain individuals had an enormous effect on policy formulation. In addition, the importance of the political and ideological orientation of Officers accounts for the concern by the GLC to create new departments staffed by politically sympathetic Officers. If Officers and Councillors hold the view that the local economy may be open to influence but not direction, then policy initiatives will tend to be more conservative. Thus, the attraction of industry to an area reflects an interest in gain for the locality, perhaps at the expense of a neighbouring authority, rather than an analysis of economic structures and processes.

Saunders (1984) locates local government in a consumption oriented framework. The productive activities of gas and electricity provision were nationalised in the post-war period, thus local government policies are consumption related, in other words, service-oriented. However, in the field of economic activity the conservative response to the identification of unemployment as a problem does not usually lead to service provision for the unemployed, but rather to small firms and other business interests. For Cochrane (1983) it is this very service orientation which, actively, leads to the provision of assistance to industry. Further, it has created a profession in the form of Industrial Development Officers whose loyalties are with business interests rather than the local authority and the local population.

Political and ideological viewpoints result in a spectrum of local economic initiatives which either build on or play-down the position of the local authority in the local economy. Policy initiatives span the largely developmental and land-oriented approaches that tend to mirror central government initiatives on inner-city and regional policy, to firm-oriented and employment-oriented policies. The latter are favoured more by the radical local authorities.

3.3 LOCAL ECONOMIC DEVELOPMENT.

Local authority activity in the sphere of economic development is not new (Camina 1974). In 1907 the Borough of West Ham advertised itself as 'the factory centre of the South of England' (Cochrane 1983). However, in the post-war period this activity was largely characterised by the provision of social infrastructure, such as education and housing, and thus only indirectly concerned with industrial development. Direct involvement in economic development, at that time, was not seen as a mainstream activity for local government. If it was practiced it was usually confined to land-use planning. The limited statutory powers available to the local authority for economic activity began to be extended in the 1960's and 1970's when a number of Acts of Parliament were introduced; the Local Authorities (Land) Act, 1963, the Local Government (Financial Provisions) Act, 1963, and the Local Government Act, 1972 (Camina 1974). The provisions made available by these Acts allowed local authorities to acquire and authorise the development of land, and provide loans and mortgages to private developers for infrastructure construction on development sites. In addition, the 1972 Act (Section 137) allowed a twopenny rate to be levied and spent on what the local authority perceived as in the interests of the area and the local population (Spencer et al.1986). Until the late 1970's these powers were not widely used. Spencer et al. (1986) argue that this was due to the caution of local authority legal officers and the absence of political pressure to develop employment policies. At that time large-scale unemployment was not a problem, its significance for the local authority only began to emerge with the economic recession of the mid-1970's. The experience of economic recession in Britain has consisted of rising unemployment, falling living standards and the industrial decline of regional and inner-city areas. Economic decline affects and overburdens the provision of services by the local authority, this stimulated a concern by many to develop their role in the local economy. The reorganisation of local government in 1974 marked a turning point, since which time economic development by local authorities has continued to increase both in numbers of policy initiatives and in their diversity (Boddy and Barratt 1980). The use of Section 137 of the 1972 Local Government Act has underpinned a large proportion of the funding for local economic activity (Young 1986).

The discussion of local economic development illustrates the difference between approaches favoured by the radical local authorities and the more traditional approaches developed by other authorities. The latter are termed developmental approaches, and largely comprise policies designed to attract private sector investment into the local area through the provision of incentives in the form of land, buildings and financial concessions, such as , rates relief and so on.

The developmental approach to economic development may be characterised by four main forms of policy initiative; land and premises, promotional activities, business advice and information and finance.

Land and premises is the most common form of local authority involvement in local economic development. Activities include the provision of nursery units for small enterprises, land release and development, some building refurbishment and ,in some cases, partnership arrangements with private developers. For example, a joint public/private development of factory units in the London Borough of Haringey meant that in return for a reduced ground rent for private developers the local authority received a percentage of rent income and thereby an interest in the survival and development of tenant enterprises (Young,Mason and Mills 1980). In addition to the Local Authorities (Land) Act of 1963, this form of activity has been underpinned by the Inner Urban Areas Act of 1978 (Young 1986) where provision was made for designated local authorities, particularly in inner-city areas, to declare specific industrial improvement areas. In these areas additional central government finance was available for land and building development. Studies of land-related local economic activity have tended to regard the practice favourably, arguing that a level of provision by the local authority is important for attracting industry to an area (Camina 1974, Robinson 1979).

An increasingly popular form of land development activity is the creation, in conjunction with Universities and Polytechnics, of Science Parks. Perhaps the most famous example is Cambridge Science Park. The aim is to provide sites and facilities close to Universities and thereby encourage links between the Universities and high-technology tenant enterprises. The initiative is designed to facilitate technology transfer between Universities and enterprises and reduce the time lag between product research and development and innovation. For example, the Science Park at Aston University; a joint effort between Birmingham City Council and Lloyds Bank, is designed to benefit selected tenant enterprises by a close proximity to research departments in pharmacy and biochemistry at the University (Guardian 3.5.83).

The 'Technology Networks' established by the GLC and GLEB and discussed in Chapter Six were based on a critique of Science Park development as overly directed toward private enterprise. The Technology Networks were designed to facilitate technology transfer from Universities and Polytechnics but with a bias toward local enterpises and the local community.

A second form of local authority economic activity concentrates on the promotion of the locational attributes of the local area. Activities vary from the publication of information leaflets, media advertising, to overseas trade missions. All are concerned to advertise the virtues of an area for the settlement of new industry and commerce. One example of this type of activity was the business exhibition; Enterprise North-West, held in 1986 to demonstrate the diversity of its new enterprises and to set out the investment opportunities available to expanding businesses. It was described as 'the largest, most important business exhibition ever held in the North of England, surpassing even the famous Royal Jubilee Exhibition of 1887' (Guardian 5.3.86). Research by the Policy Studies Institute (PSI) in 1984 found that almost a quarter of local authority respondents active in the area of economic development have promotional policies. The employment of Economic Development Officers to local authority departments often focuses on this promotional role, and the number of appointments continues to increase (Boddy 1984). However, as the prospect of 'footloose' firms looking to relocate has diminished over recent years, many authorities have redirected their promotional activities toward the attraction of tourism (Young 1986).

A third form of local authority economic activity that is widespread is the provision of business advice and information. The maintenance of registers of industrial and commercial site availability is common as a means to promote efficiency in the land market. Some authorities provide advisory services to small businesses and start-up enterprises, activities which have been reinforced by organisational innovations on the Officer side in the form of Small Firms Advice Units and Centres (Boddy 1984).

The final general heading for local authority activity is finance. The Inner Urban Areas Act of 1978 gave additional powers to designated authorities to give financial assistance to firms in the form of grants and loans, and to encourage the establishment of co-operative enterprises (Young 1986). Loans, and less commonly grants, largely relate to site and premises acquisition, but also on occasion to plant, machinery and operating costs, such as, concessions on rates, rents or interest on loans (Boddy 1984). For local authorities not included in the Inner Urban Areas Act, similar activities have used Section 137 powers and their own rate resources to provide loans (Mills and Young 1986). Thus it is not unusual to find authorities like Southwark with Employment and Industrial Units and access to a three million pound Industrial Development Fund. In its first three months of operations this Unit was working with twenty enterprises looking for assistance (Young, Mason and Mills 1980).

The activities described reflect the pre-occupation among many local authorities with service provision to private industry, seen as the most effective means of developing or regenerating the local area. For the radical local authorities the use of existing powers for land development, building refurbishment, business advice services and financial assistance to small enterprises and co-operatives was imbued with a community bias. Their concern was to direct services to a wider constituency of community and workplace groups planning for product development and the economic regeneration of their local areas.

3.4 CRITICISMS OF THE DEVELOPMENTAL APPROACH.

First, local authorities that seek to attract industry into an area assume a supply of 'footloose' industrial and commercial organisations. An assumption which is clearly questionable in the current economic climate. One effect of this type of policy is increased competition between local authorities for what is available. The end result is often the redistribution of existing industry rather than the creation of new industries (Urban Research Trust 1978, Kirby 1980).

The developmental approach is characteristic of central government policies for the regeneration of the inner cities. These policies have also been criticised as redistributive. The Local Government Planning and Land Act 1980 made provision for the extension of central government activity in local and regional development with the establishment of Free Enterprise Zones (see Anderson 1983) and Urban Development Areas in Merseyside and the London Docklands area, the latter to be administered by central government appointed Urban Development Corporations. The Free Enterprise Zones, established in 1981/2, provide exemptions from development land tax, commercial and industrial rates and training levies for locating enterprises. In addition, concessions are made available on planning controls and capital allowances. The Urban Development Corporations also use concessions to attract industry. In addition, they have powers to acquire public land and compulsory purchase private land in their area. Thus, road-building, planning and housing policies on this land are removed from the jurisdiction of the local authority (Duncan and Goodwin 1985).

Research on Enterprise Zones lends support to the redistribution argument. Rates relief comprises an important element of the subsidies available within Enterprise Zones, thus industrial and commercial re-location across boundaries is a common practice. Since 1980, it was found that 300 companies employing 3000 people have taken advantage of the Enterprise Zone scheme, however, ninety per cent of the companies involved have simply moved from areas immediately outside the zones (British Economic Survey 1984). Studies of Enterprise Zones consistently suggest that job generation within the area is at the expense of plant closure and job loss outside the Zone (Anderson 1983, Butler 1984). Further, regulations are imprecise about the type of enterprise to receive assistance. Retailing, warehousing and offices gain the most from Enterprise Zone location. Manufacturing, and especially small firms have the least to gain (Sunday Times 5.7.81, Anderson 1983). This has given rise to a second criticism of the developmental approach, that is, concessions by the local authority or in the Enterprise Zone do not guarantee control over job quantity or quality (Loney 1979, Cochrane 1983). Further, they appear to discriminate against manufacturing industry.

Third, in a study by Boddy and Barratt (1980) it was found that demand for land was primarily influenced by location. An effect of this is the reinforcement of regional and local inequalities. Industry is more likely to be attracted to areas in pleasant locations rather than where the need may be greater like the inner cities. This is an argument suggested by research on Science Parks by The Technology Policy Group at The Open University. The image of high-technology in pleasant rural surroundings, as in Cambridge for example, can act as a greater incentive to firm location than the image of high-technology in the midst of inner-city decline (Elliott et al 1984).

The provision of financial assistance to enterprises has had a mixed reception. Local authority initiatives which reflect central government activity in the Enterprise Zones and Urban Development Corporations with concessions to relocating firms have tended to attract little controversy although the effectiveness of the strategy has been questionned in terms of value for money (Shutt 1984). The most common form of financial assistance has been the use of loans and grants to help private developers construct industrial estates and other land and premises schemes. Since 1982 some local authorities, largely in the metropolitan areas, have become involved in equity investment and grants to firms and co-operatives. This form of policy has incurred criticism in two areas. First, the political selectivity of interventions, for example, the GLC commitment to restructure the London economy 'in the interests of labour, not capital' (GLC 1985). Second, the financial risk involved in intervention. Criticisms of this nature have centred around alleged failures rather than successes, for example, the headline 'Squandered Millions....' in the Evening Standard refers to an investigation by the newspaper into business deals made by the Greater London Enterprise Board (GLEB) which alleges costs to the rate-payers of between seven and a half and fifteen million (Evening Standard 18.10.85).

The aims of the developmental approach to foster private development and secure economic growth may result in job redistribution rather than job creation and give local authorities little control over planning and development or job quality or quantity. In the final analysis, the approach does not guarantee economic regeneration or a reduction of the numbers of unemployed within the local area. Although the major problem in many areas is unemployment and job loss, the connection between funding for economic development in the form of provision of land and premises and the extent to which this leads to the achievement of objectives; jobs for those in need in the area is not made. In relation to the Enterprise Zone experiment, Shutt (1984) argues that the problem of benefits to the local population is exacerbated by the weakened planning system which reduces the extent to which public participation takes place in local economic and social planning. The concern with direct employment benefits have led a number of authorities, usually the more radical, to move toward policies aimed at addressing the distributional implications of economic change through programmes designed for employment rather than growth ends. Thus a new emphasis is on policies directed at improving access to employment, improving work conditions and providing support for unemployed people and disadvantaged groups. These radical initiatives are discussed in the next section.

3.5 THE RADICAL LOCAL AUTHORITIES

The 1981 local government elections saw the left-wing radical councils, such as the Greater London Council (GLC), Sheffield City Council and the West Midlands County Council, gain power in an atmosphere of optimism about the socialist potential of the local authority. The radical economic strategies formulated by these councils were seen as a vehicle for the mobilisation of support for alternatives to the economic policies of the Conservative Government. Michael Ward, the Chairman of the GLC'S Industry and Employment Committee, wrote:

'... the Government is committed to the free play of market forces as the dominant principle of social organisation. Each successful Greater London Enterprise Board Project.....is a demonstration that there can be an alternative' (M.Ward 1983 p.16).

The radical local authorities were concerned to demonstrate the importance of public sector institutions and organisations to the economy with the pursuance of firm-oriented and employment-oriented economic development policies.

A brief description of the policies of the three local authorities mentioned above illustrates the radical approach. An approach that has been termed 'Restructuring for Labour' by some observers (Duncan and Goodwin 1986), and refers to economic initiatives which emphasise the importance of local community and workplace involvement in economic planning and development. The notion of alternative plans, socially-useful products and production for social need were important components of the economic strategies developed by these councils.

3.6 THE GREATER LONDON COUNCIL.

The title of the 1981 Labour Party Manifesto with which Labour took control of the GLC was 'A Socialist Policy for the GLC'. The slogan 'Jobs For A Change' was given to the approach. Its aims were:

1. to bring wasted assets - human potential, land, finance, technological expertise and resources - into production for socially-useful ends.

2. to extend social control of investment through social and co-operative ownership and increase trade union powers.

3. to develop new techniques which increase productivity while keeping human judgement and skills in control. (Editorial Collective 1982 p.125).

On taking office, the new Labour Group created an Industry and Employment Committee and an Economic Policy Group (EPG) to assist the Committee in the formulation of the London Industrial Strategy (GLC 1985). The London Industrial Strategy comprised a series of detailed sectoral reports on particular industrial, commercial and service sectors of the

London economy. The reports built on the knowledge of union and user groups, tenants associations, community groups and other interested parties. It was envisaged that the information would act as a base for an interventionist economic strategy designed to save and create jobs in London.

A second organisational innovation was the establishment of the Greater London Enterprise Board (GLEB); a form of public sector investment agency, as the main vehicle for the implementation of the strategy. The GLEB's major functions included; investment to provide strategic or structural change to include municipal and public enterprise and industrial co-operatives, general investment in start-up enterprises, enterprises at risk of closure and enterprises operating in areas of high unemployment. Included in the brief was the development of factory sites (Boddy 1984). The similarity of these initiatives to the Labour Party Programme of 1974 is discussed in Chapter Five.

A Co-operative Enterprise Board was also established with the specific task of encouragement and assistance to new producer co-operatives. The Greater London Training Board was involved in advice on employment planning and labour market problems and in the development of training schemes in relation to labour's needs and the London Industrial Strategy.

Popular planning formed the base of the GLC approach. That is, the active involvement of community and workplace groups in local economic development (GLC 1983). This involvement took the form of workplace and local community plans (for a discussion of the Docklands Plan see Mackintosh and Wainwright 1987) that could offer proposals for 'socially-useful' products and services. It was envisaged that these plans would begin to form the base from which wasted resources; unemployed workers, empty factories and unused machinery, could be re-introduced into the local economy. Linked to this was an attempt to involve people in the product design/development and innovation process. A number of 'technology networks' (GLEB 1982) were established to facilitate this social organisation of the innovation process, and to promote links between the expertise in local Polytechnics and trade union and community groups developing plans for socially-useful products and employment. For example, exploration of the possibilities for linking employment strategies to public sector heating needs was the basis of a 'Jobs From Warmth' plan.

Among the stream of initiatives adopted by the GLC to promote economic regeneration; bottom up popular planning, enterprise planning, industrial democracy, co-operatives, socially-useful products and services, and technology networks, this thesis focuses on the initiatives relating to the technology networks. The case-studies are presented in

Chapter Six, and in addition some comparative reference is made to the strategies for technology developed by Sheffield City Council and the West Midlands County Council.

3.7 SHEFFIELD CITY COUNCIL.

In May 1981 the Labour-controlled Sheffield City Council established a new Employment Committee and Department. The objectives were summarised in 'An Initial Outline' document published by the Department. The stated aims were:

'to co-ordinate everything that the City Council can do to help:

1. prevent further job loss in the city,

2. to alleviate the worst effects of unemployment and to encourage effective training for new skills and jobs,

3. to stimulate new investment, to create new kinds of employment, and to diversify job opportunities in the city.
4. to explore new forms of industrial democracy and co-operative control over work.' (City of Sheffield Employment Department 1982 p.2).

Like the GLC, Sheffield Council sought to develop a directly interventionist role in the local economy. The Employment Department, staffed by politically committed people from outside the traditional local government professions, began work in 1982 with a budget of two and a half million. Eight project teams were established to work on the following areas;

Research and Resource Team - to develop an early warning system for changes in the local economy, and to help prevent the loss of future jobs, through the development of alternative employment plans for key firms, industries and sectors, in dialogue with those who work in them and those who use their products or services.

Equal Opportunities (Women and Employment) - to investigate the employment situation and needs of women and to develop job-creation and (re) training proposals for positive action both inside and outside the local authority.

Training for Employment - to work with other agencies to develop a training policy and plan for key sectors of employment in the city; identifying specific future skill requirements within the local economy; promoting tailor-made (re) training programmes; and co-ordinating a critical response to the Manpower Services Commission make-work schemes.

New Technology and Product Development - to monitor the impact of new technologies upon existing employment; to identify and generate opportunities for diversification into new, human-centred technologies, skills and jobs.

Aids to Enterprises - to offer financial assistance, specialist advice and premises to support existing and new firms, workers' co-operatives and job creation projects willing to negotiate a planning and economic agreement with the City Council.

Economic Development - to investigate the opportunities for directing large-scale investment in the local economy, through co-financing arrangements with institutions (eg. banks, pension funds) and the best organisational arrangements for managing such investments (eg. local enterprise boards).

Municipal Enterprise - to explore opportunities for the local authority to generate jobs by an expansion of its own role as a local investor, trader and provider of services.

Industrial Development - to promote Sheffield industries and products nationally and internationally, by organising local participation in trade-fairs, together with marketing advice and assistance; and to attract new firms and new investment to Sheffield. (Reprinted in 'Struggles in the Welfare State', Critical Social Policy, Spring 1984).

The Department encouraged the development and modification of policies by discussions with people involved in the women's and labour movements. From 1982, increasing emphasis was given to public sector employment initiatives. In 'Strategies for the Employment Department 1983/4' (City of Sheffield 1983) support was given for campaigns against expenditure cuts and privatisation, and other projects relating to local authority employment initiatives.

Sheffield City Council developed a two-pronged approach to technology. On the one hand, the Sheffield Centre for Product Development and Technological Resources (SCEPTRE) was established jointly by the Employment Department and the City Polytechnic in 1983. The aim was to support enterprises, and co-operatives, in the development of socially-useful products, processes and services. A central feature of the product development process was a close relationship between producers and users.

SCEPTRE offers specialist advice in engineering, metallurgy, marketing and business development and, in some cases, with finance and premises. Since its formation it has;

- Established a bank of product, service and process ideas.
- Developed some product proposals to the prototype stage.
- Assisted in prototype to full production activity.
- Provided a general technical service for approved projects. (Sheffield in the 80's 1985 p16).

On the other hand, Sheffield City Council were keen to encourage the introduction of more conventional new technology. In the same report; 'Sheffield in the 80's', it was stated that:

'In co-operation with the Department of Trade and Industry, South Yorkshire County Council and the City Polytechnic, the City Council has helped to establish the Micro-Systems Centre in Sheffield to give advice on the introduction of new technology to private firms and co-operatives, and has supported other initiatives which ensure new technology is used to enhance employment and benefit industry'.

A further initiative was a land development scheme adjacent to the University and Polytechnic for a Technology Campus. It is envisaged that this would provide a focus for industries using new technology. In a Presentation Summary to Sheffield City Council in September 1985 the objectives of the Technology Campus were described:

'The central objective of the Technology Campus is to provide the right environment, resources and location for the development of new technology industries. It is intended to encourage new industries and provide new employment, making research resources available and assisting an interchange of ideas and joint use of facilities.

The aim is to foster a wide variety of research-based industries using new and existing technologies, particularly in electronics, computing, materials and biotechnology.

It is envisaged that the Campus will include flexible workspace, a business development centre, product development workshops, high quality business units and accommodation for technology- based industry. (Ibid. 1985 p2)

Sheffield City Council had a commitment to innovation and the development of socially useful products. In addition it was keen to support the adoption and diffusion of new technologies (eg.IT). The possibility of changing the direction of technological advance through the development of socially-useful products was set against the realities of economic decline and the view that the private sector uptake of new technology is important to the local economy. This dual approach is also evident in the policies of West Midlands County Council and is an area that will be discussed in relation to the policies of the GLEB in the case-study.

3.8 WEST MIDLANDS COUNTY COUNCIL.

The West-Midlands County Council (WMCC) created the West Midlands Enterprise Board (WMEB) in 1982 with a budget of three and a half million. The main objective was investment in medium-sized companies with a potential for long-term growth and employment creation. The concentration on indigenous manufacturing enterprises of a medium-size was based on results from past experience which indicated that assistance to both small and multiplant firms was poor value for money (Young 1986). The longterm nature of an investment strategy by the WMEB was emphasised as central to policies aimed at economic growth. An attitude voiced by Richard Minns; a key figure in the West Midland Enterprise Board (WMEB):

'...the positive commitment of the investor to the productive process rather than an interest in short-term money management. Through planning agreements, involvement of unions and organisations like the shop stewards' movements (with their ideas for retrainig and building on workers' engineering and production skills), the investments would be part of a new approach to the planning of production with finance firmly linked to a long-term view of the productive process' (Minns 1982 p96).

The WMEB was established as an independent company with Directors appointed by the Economic Development Committee of the West Midland County Council. It was financed under Section 137 of the Local Government Act of 1972 which made provision for a two pence rate to be spent in the interests of the community. It was envisaged that pension fund finance, including the local authority pension fund, would provide additional funding. The WMEB functioned alongside an Economic Development Unit. It was responsible for industrial strategy (it was intended to base investment on sector analyses) and monitoring, as well as income maintenance, training, Council purchasing policy, co-operatives and other economic initiatives which relate to income support and redistribution (WMCC 1984). Although the main focus of the policy was on medium-sized firms, support for co-operatives was seen as an important factor, particularly if related to unemployed workers attempting to develop products and retain skills.

The WMEB exhibited some commitment to the development of alternative technologies by their support for the Unit for the Development of Alternative Products (UDAP) based at Lanchester Polytechnic in Coventry. UDAP was established in 1981 to fill the need for engineering and technical assistance on some of the product proposals which emerged from the Lucas Plan (Wainwright and Elliott 1983). The support for UDAP by the WMEB was particularly aimed at the encouragement of co-operative enterprises; UDAP provided ass istance to co-operatives and small enterprises wishing to develop alternative products.

In the main the technology policy developed by the WMEB was closely linked to its industrial policy. It emphasised the deployment and use of existing technologies rather than the design/development of new products. The WMEB's industrial policy focused on the regeneration of mature industries. A major role for technology initiatives was to make both workers and enterprises more aware of the potential benefits of new technology. To this end a Technology Transfer Centre was set up jointly with Aston University, and an Advanced Manufacturing Demonstration Network became operational in 1986. In an overview article on the West Midland Approaches to Technology Transfer, Liff (1985) defines technology transfer as 'a form of innovation which does not require the firm applying the new technology to undertake original research and development work' (Liff 1985 p5). The main objective of the Technology Transfer Centre was the dissemination of information relating to innovations relevant to West Midland industries.

Technology policy for the WMCC was aimed at the diffusion of new technologies, but also there was an awareness of the potentially adverse side-effects of its adoption; de-skilling and job loss. The Council Training Programme acknowledged the possibility of alternative applications of technologies that could benefit both workers and employers. The Training Programmes sought to break down sexual and racial skill divisions, provide training in new technologies, and also to develop two new areas;

- New Technology Awareness which gives workers and communties the skills to evaluate proposals for new technology and develop alternatives;

- New Technology Agreements; advice to trade unionists on how to negotiate over issues concerning new technology (Ibid. p8).

3.9 CENTRAL AND LOCAL GOVERNMENT RELATIONS.

The economic initiatives developed by local authorities have depended on the creative exploitation of their limited powers. Economic development is not a local authority activity backed by statutory powers. For the radical Councils local government provided the base for experiments in popular democratic planning and development. The policies were designed to present a practical example of an alternative to Thatcherist policies for social, economic and political change. This ideological and political role for local government was seen by many as the prime reason for the flurry of legislative measures imposed on local authorities by the Conservative Government during the 1980's. Whilst this view may be overstating the significance of these alternative policies, certainly their implementation has been severely limited by changes in legislation.

A major concern for the Conservative Government since they took office in 1979 has been the control of public expenditure. Exemplified by efforts to 'roll back the frontiers of the state' with the privatisation of government services and nationalised industries. Attempts to control local authority spending have resulted in two major pieces of legislation; rate-capping and the abolition of the higher-tier authorities in London and the metropolitan areas.

Local expenditure controls and the search by the Conservative Government to restrict the size of the public sector through privatisation fuelled political debate over the erosion of local democracy. Cochrane (1985) summarises the criticisms of the Government's approach to the problem of local government. They tend to take three forms. First, the stated aims of the government of reducing spending, increasing efficiency and removing an unreasonable burden from non-domestic ratepayers have been challenged in their own terms. Second, the legislation has been seen as an overt attack on Labour-controlled authorities who are concerned to block the government's attempts to restructure the welfare state, particularly in the areas of housing, education and social services administered at the local level. Third, criticisms revolve around the erosion of local autonomy and local democracy, seen as the right of local people to choose their own levels and forms of service provision. This point was reinforced by Kirby (1980) who noted that the 'right to buy' for council tenants introduced in the 1980 Housing Act removed council discretion over housing stock sales. In addition, the establishment of Enterprise Zones and Urban Development Corporations has overruled local democratic control over local matters in the local area (Shutt 1984).

The economic policies of the radical councils need to be seen against a background of increasing change and tension between the centre and the locality. A tension that is illustrated by the increasing willingness of both parties to resort to litigation to solve their differences. The 1980's have been witness to the ruling against the GLC's cheap fare policy by the House of Lords judgement, a new Transport Act which imposes limits on subsidies to public transport in urban areas, Norwich City Council forced to comply by the courts with the 1980 Housing Act and sell their council housing stock, and Lothian Regional Council forced to agree to the Secretary of State's demands for expenditure cuts in the face of the threatened appointment of commissioners to take over the elected council (Boddy and Fudge 1984).

However, it is the more fundamental financial changes which have severely limited the autonomy of local councils. The Local Government, Planning and Land Act of 1980 introduced a system of financial control in England and Wales which included central government decisions on spending targets for local authorities. Penalties were introduced on individual local councils if their spending was not contained. This piece of legislation was followed by the Local Government Finance Act 1982 which gave the government control over both local expenditure and local income. This was achieved by the abolition of the right of the local authority to levy a supplementary rate to compensate for the short-fall in government grant.

With the Conservative Government victory in June 1983 more plans were presented. Rate-capping was introduced with the 1984 Rates Act. It included measures to fix council spending levels and the amount to which they could raise through the rates. These rate-capping plans were directed at the high-spending councils (usually Labour-controlled). Plans also included the removal of the control of London Transport from the GLC, and the subsequent abolition of the metropolitan authorities (Greater Manchester, Merseyside, South Yorkshire, West Yorkshire, West Midlands and Tyne and Wear) and the GLC itself (Guardian 27.6.83).

This conflict between central and local government is not a new phenomenon, the issues of poor relief and payment for public works were redistributive policies which led to political battles in the 1920's. Poplar is a famous example of the way that local interpretations of need, on occasion, conflict with those laid down by central government. In this instance, Labour majorities controlled both the Borough Council and the Board of Guardians who administered the Poor Law. Conflict over levels of poor relief between the government and the Poplar Guardians; who insisted on paying higher rates of assistance, led to an Order issued by the Minister of Health of 1922 prohibiting excess payments and imposing surcharges on the Guardians who exceeded these limits. However, the payments continued and no attempt was made to apply the Order or to collect the surcharge. The abolition of the Poor Law in 1929 led to the replacement of all Boards of Guardians by local authority public assistance committees, and a number of localities followed the example set by Poplar (see MacIntyre 1980). The effect of this rebellion, and the resulting outright confrontation between the Government and Labour-controlled Rotherham and Durham County Council was the supersession of their local public assistance committees by government commissioners. In 1934 legislation was passed which transferred the issue of unemployment relief out of local politics to a new Unemployment Assistance Board (Gyford 1985).

A more recent example was Clay Cross in the early 1970's. The local population supported Councillors' refusals to implement central government housing policy. This resulted in the legal dismissal of local Councillors and the appointment of a central government Commissioner to run council housing in their place. The attempts by Labour-controlled councils to resist the rate-capping legislation of the present government is another example.

In the Rates White Paper which preceded the 1984 bill, two main arguments were presented for cutting local government spending; first, it is only by cutting the levels of public spending, and thus holding down the tax burden, that the economic regeneration of the country could be secured, and second, that rates had become an excessive burden on business costs, eroding competitiveness and thereby destroying jobs. However, no evidence was presented that cuts in public expenditure have beneficial effects on economic performance (Jackman 1984).

Throughout 1984 the government faced a series of challenges to the Rates Bill and the plans for the Abolition Bill; a one-day tube and bus strike in London, a 'Day of Democracy' held by the TUC, and the series of events in Liverpool leading toward the council passing a budget that would mean bankrupcy for the city.(Sunday Times 25.3.84). The Labour Party conference on local government held in July 1984 spawned the beginnings of the 'No-Rate campaign'. Delegates agreed that they would refuse to comply with the Government's demands for cuts in jobs and services, and proposals were put forward for united resistance tactics for all Labour councils to follow for the 1985 budget (Guardian 7.7.84). The strategy meant that many Labour councils would refuse to make a legal budget in the spring of 1985 unless the government relented over its new arrangements to reduce spending.

The leaders of the sixteen Labour controlled councils which were selected for rate-capping control by the Government agreed on a policy of total non-compliance. The GLC resorted to litigation and attempted to get the Environment Secretary; Mr Patrick Jenkins' rate-capping policy tested in the courts. (Guardian 13.2.85). However, as the time to make a rate grew closer rifts began to emerge among the Labour Left. For the lower-tier authorities failure to make a rate left them with an opportunity to do so at a later date before the district auditor could step in to bring an action in the courts. The situation was different for the higher-tier metropolitan authorities who had a legal obligation to make a rate by March 10th. If Councillors failed to do so they could be surcharged, disqualified from public office and possibly bankrupted. Faced with this Merseyside and South Yorkshire proposed to fix a legal rate and embark on a programme of covert deficit budgeting. This left the political pressure to support the no-rate option on the GLC and the Inner London Education Authority (ILEA). After long debate and rifts in the GLC Labour group, the GLC fixed a rate below the Government's legal maximum (Carvel 1985). One by one the lower-tier Labour authorities fixed a rate and avoided outright confrontation with the Government.

The Abolition Bill began its route through the Commons early in 1984. A major victory of the vigorous campaign launched by the GLC was the defeat of the paving bill that sought to abolish the 1985 elections (Guardian 29.6.84). Amendments to the Bill ensured the life of the authorities until their proposed abolition on April 1st 1986, but new clauses, designed to limit the propaganda campaign against the abolition of the GLC, meant that ministerial approval was required before signing new contracts for engineering and building works worth more than `250,000 and all other schemes, including publicity campaigns, costing over `100,000 (Guardian 12.7.84). The bill paving the way for the abolition passed its final hurdle in the Lords in July 1984, and the GLC and the metropolitan authorities were abolished on April 1st 1986.

These instances point to the constant possibility of confrontation between central and local government, tighter legislative measures usually follow as central government reasserts its control. Duncan and Goodwin (1985) argue that the current spate of legislative measures by central government need to be located in this context.

The conflict between central and local government has been seen by some commentators as a conflict between political democracy and 'economic' democracy (Blunkett and Jackson 1987). The attempts by the Conservatives to redefine the boundaries of local government with their encouragement for the market provision of services is in effect a more limited role for local government which explicitly rules out redistributive policies at the local level (Bramley 1984). Thus the conflicts are technical/administrative concerning the most cost-effective means of service provision, and political, concerning the allocation of resources to services (SAUS 1983). Blunkett and Jackson (1987) argue that the ideological confrontation between the centre and the locality has its roots in the development of radical economic strategies that changed the political agenda and began to challenge the Government's policies in practice. Politics is about setting agendas for what should be done and how it can be achieved, the economic strategies of the radical authorities began to challenge the 'commonsense' economic policies of the Conservative Government.

The intuitive appeal of these arguments is strengthened by the historical examples of Poplar and Clay Cross and the legislative measures which followed these events. The reduction of local government autonomy, the spate of court cases, and the increasing financial limitations on radical initiatives all contributed to the decreasing room for manoeuvre for economic policy initiatives. The abolition of the GLC in 1986 meant that the institutions established to implement their economic strategy faced severe financial constraints. This needs to be borne in mind in any attempt to assess or evaluate these policy initiatives.

At the time of writing the GLC and the West Midland County Council have been abolished. Sheffield City Council remains, but, in March 1988 the Government announced plans for an Urban Development Corporation in Sheffield which will override the powers of the local authority in this designated area.

3.10 DISCUSSION AND CONCLUSION.

The radical local authorities proposed an interventionist economic programme. This chapter has illustrated the differences between the economic policies of the radical local authorities, and the largely developmental approaches usually favoured as economic activities for local government. However, this is not to imply that radical local authorities did not also include developmental policies in their overall portfolios. Three effects of the radical policy initiatives are immediately apparent. First, interventionist policies represented a creative departure from developmental local economic policies and traditional assumptions about the role of the local authority in this area. Radical initiatives led the way for other local authorities to investigate firm and employment-oriented policies. Second, the GLC changed the administrative base of local government by creating new departments and appointing politically sympathetic Officers working more closely with Councillors. Third, the 'There is an Alternative' approach fuelled political debate about the privatisation of local services, the erosion of local democracy and the economic policies of the Conservative Government. What the radical local authorities set out to achieve was the restructuring of the local economy in the interests of labour. The reason why was as a demonstration of a socialist alternative to Thatcherism.

The question which emerges is whether strategies were primarily a political exercise or the presentation of a real economic alternative. The discussion of the legislative and financial constraints on local authority powers concluded that their activities were limited. This is particularly marked in the national economic context where intervention on a local scale faces severe problems; the ownership and control of most local industries lies outside the locality and often outside of Britain altogether. Bennington (1985) illustrates this point in the context of Sheffield where an average of a thousand jobs lost per month in the private sector was compared to the best estimate of jobs directly created or sustained by the Employment Committee as a thousand over two years. This statistic places attention on numbers of jobs (always an uncertain calculation) but in terms of costs the measures taken by the Enterprise Boards compared favourably with the Government's Enterprise Zone experiment with costs per job of around five thousand pounds as against costs of around sixty-five thousand per job in the Enterprise Zones (Bennington 1985).

If compared to the developmental approach taken by local authorities then the radical initiatives do address some of the problems. The 'jobs at any price' attitude (Loney 1979) was clearly addressed by the use of planning agreements to influence the number and quality of jobs created. This potential for change and the achievement of wider policy objectives; equal opportunities, increased industrial democracy and so on, depended on the amount of leverage that the local authority could attach to subsidies. The important factor was their implementation. Cochrane (1983) draws attention to several points of difficulty; even though firms may be in receipt of financial assistance it does not necessarily follow that they will uphold a commitment to planning agreements (although there were efforts by the GLEB to monitor agreements and gain the active support of the trade unions concerned in the enterprise). For small firms, dependent on the market and the policy decisions of larger companies, fulfilment of agreements may be restricted. In subsidiary companies, local planning agreements may not hold much sway against the national and often international plans of the parent company. These problems again reflect the dilemma of economic intervention, local authorities operate in a locality whilst firms operate in a national and international context.

The emphasis in radical economic strategies of support for co-operatives was also an area likely to be limited in its contribution to economic regeneration since co-operatives face the same problems as small firms trying to compete in a hostile economic climate.

Further criticism of the radical approach has been voiced by commentators who question the radical nature of these economic strategies. They argue that the Enterprise Boards established by the GLC and WMCC, whilst concerned to achieve some long-term input into the decision-making of private industry through equity share-holding, are also providing cheap capital to private industry, and in this way reflect the more developmental forms of economic policy which subsidise industry and commerce (Cochrane 1983, Boddy 1984).

These arguments suggest that for any initiative a local authority does not have the resources to effectively intervene in the local economy. Rather their strength lies in their role as employers, purchasers and providers of goods (Boddy 1984, Bennington 1985). The creative use of this role and existing powers enables an authority to fulfill many of the points put forward by the Royal Town Planning Institute Report (see 3.2) in the areas of local employment, planning, monitoring the local economy and facilitating the creation of investment opportunities. The local authority is a major employer in the local area so that recruitment, positive discrimination and training policies can have a major effect on the local labour market. The local authority's capital programme represents important investment resources for the local area, providing business for local firms. For example, Sheffield's capital and revenue spending of eighty-four million on construction, repairs and related building activity is estimated to account for over three-quarters of all investment and employment in the local construction industry (Bennington 1985).

Another important area of influence for the local authority is purchasing power and its use to stimulate the local economy. The GLC had purchasing power of a thousand million pounds a year, while Sheffield spends approximately eighty million pounds. Although the local authority is legally bound to purchase the cheapest products available, there are possibilities in this area for the development of locally manufactured alternatives to those goods which are currently imported. Municipal enterprise and the local authority as producer has a long history (Saunders 1984), which still includes Direct Labour Organisations. The potential for the development of this function by the local authority was investigated by the radical initiatives, for example, the GLC campaign for 'Jobs From Childcare' and 'Jobs From Warmth' (GLC 1983).

The position of the local authority is a prime one for the identification of needs relating to service provision. This is particularly true for those areas where collective provision is a more sensible approach or areas where there is insufficient consumer demand for the private sector development of goods and services. The popular planning approach, of which the technology networks played a central role, promised a means by which the local authority could act in a catalytic way to link users with unmet needs, unemployed workers and redundant technical capacity. In some cases there was the possibility for the local authority to provide the finance, the skill to develop the product and the purchasing power to provide a stable market. In effect, an alternative economic strategy that generates employment through public-sector led investment and purchasing to meet needs for collective service provision. This as a direct contrast to the private market mechanism geared primarily to individual consumption (Bennington 1985).

The GLC and Sheffield City Council, took on board these ideas on 'socially-useful' production pioneered by the Lucas Plan, and created the facilties in the form of the technology networks in London and SCEPTRE in Sheffield. These are discussed in Chapters Six. While in some parts of its work WMCC adopted a similar approach via UDAP, there are important differences. The WMCC policy focused primarily on 'diffusion' (the provision of information on existing ideas) rather than the support for product design/development and innovation.

Given the limitations on policy initiatives for local authorities with only limited political and economic power, there are three main ways that the radical initiatives have exerted an influence:

1. the radical economic initiatives have questionned and

challenged the complex of political, legal and ideological assumptions and limitations over what local authorities can and should do.

2. they have challenged interpretations of how the economy works, who it works for and how it should work. Both the Left and the Right of the political spectrum are agreed that these alternatives represent political pilot schemes (Duncan and Goodwin 1985).

3. they have challenged the notion of local government and local politics as centred aroud service delivery, rather a process of campaigning and political mobilisation has been advocated. The effect of building popular support for alternative strategies, changing the political agenda, and supporting the developent of durable initiatives outside of the local authority were seen as particularly important, for example, the community and trade union resource centres and the technology networks were created as on-going political/technological projects (Boddy 1984).

Clearly, the radical local economic strategies represented challenges to the economic policies of the Conservative government. The expansion of the role of local government in local economic development has not been actively supported by central government, but in the case of the radical local authorities it has been actively discouraged. Rate-capping particularly, puts economic initiatives at risk, in an atmosphere of scarce resources the local authority must meet statutory duties first. Closer examination of the radical initiatives highlights the difficulty of intervention and the practical example of an alternative. Local authorities have little real power to influence economic change directly. Their position as agents of technological change are limited for the same reasons. That said, and mindful of the constraints and position in the national political context the case-study presented is of the GLC's radical technology policy. In the next chapter on the methodology of the research an assessment or evaluation of the policy initiative is discussed in relation to these constraints.

CHAPTER FOUR: THE METHODOLOGY.

4.1 INTRODUCTION.

The central feature of a research project is the methodology or the selection of research methods, be they participant observation, scientific experiment or survey techniques. The methodology acts as the link between theoretical ideas and research activity. It provides the framework for the theoretical analysis of the research problem. This chapter seeks to explain and discuss how the general questions of this research project led to the choice of a case-study research design, and the employment of a variety of methods for the data collection.

The choice of data collection methods has important consequences for a research project. For example, the use of one single method often cannot illuminate all aspects of the reality under investigation. 'Multiple triangulation' is a strategy advocated by Denzin (1978 2nd ed). It is based on the combination of several different methods or techniques of investigation on the same unit of analysis.

The aim of this type of approach is to positively affect the validity and reliability of research findings. The argument underlying the approach rests on the belief that the choice of research methods is not an atheoretical activity. The study of the same phenomena using purely participant observation techniques, or only survey techniques would lead to qualitatively differing conclusions. Denzin states:

'I have repeatedly suggested that the sociologist should examine a problem from as many different methodological perspectives as possible. My definition of each method has implied a triangulated perspective. Participant observation was seen as combining survey interviewing, document analysis, direct observation and observer participation' (1978 p291).

In this research project an attempt has been made to be guided by this approach. An approach which has been taken up by social researchers generally.

4.2 RESEARCH QUESTIONS.

The research project began in October 1982. The interest in the project was as a continuation of research on the development of socially-useful products by workers at Lucas Aerospace. Research on the Lucas Plan (Wainwright and Elliott 1983) had been undertaken by members of the Technology Policy Group at The Open University. Some of the key personnel involved in the development and research on the Lucas Plan had moved to the Greater London Council (GLC) when the Labour administration took office in May 1981. The main focus of the research was to explore how the technology policy issues arising from the Lucas Plan could be developed in the context of a local authority: the GLC. The underlying theme may be illustrated by a general and rhetorical question voiced by a leading member of the Lucas Shop Stewards' Combine Committee:

'...why, when we have the technology to build Concorde are people still dying of hypothermia?' (Cooley,1985 p19).

This question relates to the allocation of resources to, and the priorities for, technological development. In addition, it highlights the general problem of why certain technologies are developed and others are not, even though there may be a perceived social need for them. This theoretical and practical problem located in the context of a local authority led to the formulation of the two general research questions of the study.

First, why do certain innovations lead to development and commercial exploitation, why others do not?
Second, how can a local authority develop and implement a technology policy that is based on social need?

The research project took the form of an exploratory study. The technology policy proposals formulated and implemented by the GLC represented a new departure for a local authority. Given the absence of a readily available body of existing research into the area the testing of tightly constructed hypotheses and operational definitions was deemed inappropriate. In this sense the research was concerned with theory generation as an on-going activity during fieldwork, rather than theory testing: this is an approach that has been advocated by Glaser and Strauss (1967).

4.3 THE CASE-STUDY APPROACH.

The nature of the research project benefited from a case-study approach. The project was of a real-life set of events unfolding during the period of the research: 1982 - 1986. It was a longitudinal study in which particular reference was made to the exploration of the factors affecting policy implementation. For an exploratory study the attitude of seeking, rather than testing, requires a flexible framework which allows for adaptation and change as the researcher discovers more about the case. Inquiry is constantly in the process of reformulation and redirection as, guided by the features of the study, new information is obtained or emerging hypotheses require new information (Selltiz 1976).

There were several reasons why the case-study approach offered an appropriate research design. First, a case-study provides a framework within which various research methods can be employed. In this way it is possible to amass multiple sources of evidence using a range of research techniques; participant observation, interviewing and primary and secondary documentation. Second, case-studies are usually preferable when the aims of the study focus on the understanding of the diffuse causes and effects of change (Moore 1987). The emphasis on change allows investigators to trace a complexity of developments and to collect insights into processes operating over a period of time (Selltiz 1976). Third, the approach makes it possible to look in some depth into a particular issue.

This research project required an approach that could offer the opportunity to observe and analyse, in some detail, an event of historical importance, namely, local authority involvement in a radical technology policy.

The selection of the 'technology networks' as units of analysis within the case-study was based on their comparability, but as importantly, as representative of a range of alternatives which enabled the idea of socially-useful product design/development to be considered by how it is treated in different circumstances.

Fourth, as an exploratory strategy, case-studies allow the flexibility to generate hypotheses even though there may not be a clear set of outcomes from the policy process (Yin 1984).

The criticisms that are made of the case-study research design tend to fall into two main areas. First, it is argued that lack of rigour may lead to bias of findings and conclusions. Second, the ability of the case-study to provide a basis for scientific generalisation is questionned (Yin 1984). Case-studies rely on the ability of the researcher to draw together many diverse bits of information into a unified and coherent interpretation of events, thus it must be conceded that there is a danger that conclusions may reflect the researcher's predispositions rather than the object of study. However, even if this criticism is appropriate to many case studies, it may not be wholly undesirable for research that is aimed at generating, rather than testing, hypotheses. In addition, it is a criticism that can be aimed at almost any form of research endeavour. With an awareness of the dangers of bias, care can be taken by the researcher to amass multiple sources of evidence using differing research techniques, which may go some way to averting criticisms of lack of rigour. In relation to the second criticism, again case-studies do lack the statistical validity of samples that have been properly selected. The extent to which valid generalisations can be made depends on the degree to which the case studies themselves are typical and the care used in drawing conclusions (Moore 1987). However, it is important to note that exploratory studies merely lead to the presentation of insights or hypotheses; they do not test or demonstrate them. The selection of a case that has special features such as this project has in relation to local authority technology policy means that by definition the chosen case-study is not typical. An exploratory study needs to be seen as a first step; more carefully controlled studies are required to test whether the hypotheses that emerge have general applicability (Selltiz 1976). The case-study is appropriate for trying to find clues and ideas for further research, although the findings may not provide a basis for scientific generalisation, this does not preclude the possibility of relating empirical evidence to theoretical propositions and thereby generating hypotheses that may lead to the expansion of theory in a relevant area. This is the ultimate goal of this kind of research work (Selltiz 1976, Yin 1984), and the aim of this research project.

4.4 FIELDWORK.

The fieldwork on the project fell into two separate stages. First, from January to June 1983, a pilot study using participant observation techniques. During this period the aim was to learn more about the policies being developed by the GLC, and thereby gain an overview of their general approach. This period provided the opportunity to formulate the research questions which formed the base of an interview schedule undertaken largely during the period November 1984 to March 1985. Throughout the project extensive secondary source material was collected and meetings of groups relevant to the research were attended. This consisted of attending the Popular Planning Forum, and meetings arranged as part of the Jobs From Warmth campaign. The methods used in the initial pilot study phase of the project are discussed first.

On taking office in 1981, the Labour administration set about the establishment of an Economic Policy Group (EPG) and a Popular Planning Unit (PPU) at County Hall and, at a later stage the Greater London Enterprise Board (GLEB) at the Elephant and Castle. Initially, the focus for the fieldwork was the PPU. This Unit was concerned to publicise the GLC's economic strategy and to encourage forms of participation in the policy development process. Participation was articulated as an important element of the proposed GLC technology policy. Participant observation techniques were used to build a picture of events at the PPU.

Gold (1958) distinguishes four degrees of involvement for observation methods: the complete participant, the participant as observer, the observer as participant and the complete observer. The complete participant role is covert within a group or organisation and the intentions of the researcher are not revealed. Adoption of this role would have meant joining the PPU as a full-time employee which was not appropriate. Instead, an attempt was made to join the Unit in a 'participant as observer' role. In this case the researcher makes their presence known. The objective is to form a series of relationships with the members of the group relevant to the research project. Nachimas and Nachimas (1976) note the potential problems of this role:

'A participant as observer confronts three major problems - establishing relationships with members of the group, finding sourceful and reliable informants and maintaining the observer-observed relationship'(p 93).

In the PPU all of these problems were experienced.

The first problem was negotiation of access. Contact had been made with one of the Unit's members but this person was not present at the first meeting with other members of the group. Permission was requested to work voluntarily at the Unit for two days a week in order to gather information about their activities and objectives in relation to the encouragement of local participation in the GLC's economic policy development. At this meeting the group members present were resistant to this suggestion on the grounds that they already had placement students, they were unsure of the value of my potential contribution, and they were uncertain as to my political sympathies regarding the work that they were doing. The decision was made to discuss the matter when all of the groups members were present. Another meeting was arranged, the outcome of which was that access was agreed, albeit reluctantly. In January 1983 I began to work voluntarily at the Unit for two days a week doing routine clerical and administrative tasks. However, the difficulties of acceptance were a constant problem. The pressure of work in the Unit was high and most members worked long hours and had little time for discussion, this made the establishment of key relationships difficult.

Confidentiality was another area in which problems were encountered. Although it had been discussed and agreed in principle at the outset of my involvement at the Unit, in practice this worked rather differently. I had access to all written material emerging from the Unit and attended some general policy strategy meetings, but some group members remained uneasy about this. Confidentiality was an individual prerogative and some group members found it difficult to talk openly or freely with 'outsiders' present.

This problem was due to the political sensitivity of the work of the Unit and the hostile media coverage of the GLC'S activities at that time.

I worked at the Unit for approximately six months. Increasingly my time was taken up with the ever-growing administrative tasks (I became responsible for the mailing list). As a consequence of this the maintenance of a role as a researcher became a problem. The tendency was to disappear into the structure of the organisation, with little time for systematic data collection. During the time at the Unit the data gathered was largely background material on the GLC's policy initiatives. I kept a research diary and a notebook to jot down discussions of policy strategy in the Unit, and to monitor the types of educational and publicity strategies used to encourage participation in the Council's initiatives. The findings from this period of research are presented in Chapter Five.

4.5 FIELDWORK AT THE GREATER LONDON ENTERPRISE BOARD.

Aware of the difficulties that I may encounter with a participant observation approach, I subsequently began a period of fieldwork at the Greater London Enterprise Board

(GLEB) from October 1983 to February 1984. A degree of access was negotiated for a presence of one day a week in the Technology Division at the GLEB. The atmosphere in the Technology Division at that time was largely defensive; the organisation was a recent innovation by the GLC and there was a period of finding it's feet. The GLEB had been established as an independent organisation charged with the implementation of the GLC's economic policy in July 1982. As an agency that provided financial aid and advice to businesses in the London area it was inundated with requests for assistance. There was a reluctance to allow me open access to files, particularly those containing material of a commercially or politically sensitive nature. The uncertainty of the staff in the Division to their role and the role of the organisation as a whole in this early stage of its history also acted as a barrier to the collection of information. Thus this period was used to amass documentary evidence (minutes of meetings and so on) of the Technology Division's activities, particularly around the establishment of a series of 'Technology Networks'. These networks became the focus of the research and are described in Chapter Six.

The data collected during this period of fieldwork was largely descriptive: it related to the background of the GLC's overall policy initiatives and more specifically to their technology policy. The data gathered was not for the purposes of proof of a hypothesis. Rather it was an exploratory exercise to gather the information necessary to the construction of questions for an interview schedule. The nature of the data collected up to this time was published material by the GLC and the GLEB, Council minutes and minutes of meetings.

Organisational bias and selectivity of reportage are acknowledged as factors that act to diminish the validity of collected data. There was an attempt to check information by informal conversations with the people at the PPU and in the Technology Division at the GLEB. Where possible, checks were made using secondary sources in the form of articles about the GLC initiatives which appeared in academic journals and newspapers. Regarding the newspaper items, the political bias of the reportage was taken into account by noting the structure of the articles and their sympathetic or unsympathetic response to the GLC's approach. In certain newspapers the bias was consistent over a period of time.

4.6 FRAMEWORK FOR RESEARCH DESIGN.

The next stage of the research process, the period March to September 1984, was to focus the study into a manageable project. This period was used to formulate the questions to be asked in the interview schedule, to identify the relevant units of analysis and the form of data analysis that would be appropriate for the case-study. The fieldwork completed showed that the key units of the technology policy formulated by the GLC and in the Technology Division at the GLEB were the Technology Networks. Five Technology Networks were established to promote the design and development of socially-useful products. A central feature of the technology network strategy was the encouragement of participation from community, trade union and user groups in the selection, design and development of products. The Technology Networks were chosen as the units of analysis of the study. The identification of the Networks as the focal points of the study was followed by a period of literature search to see how this could aid the research structure.

The research question that emerged was how could a local authority generate a technology policy based on social need. The research aim was to link the theoretical problem of why certain technologies are developed and others are not with a possible explanation based on the research findings of the study. The research findings would then generate further hypotheses for further research.

The literature review showed that the methodological base of innovation studies tended to comprise technical and organisational factors as relevant units of analysis, for example, R&D capacity, size of firm, management strategies, marketing techniques and so on (see Freeman 1982). The 'success' or 'failure' of an innovation was based on commercial criteria, such as market share and profitability. The innovation studies perspective allows the selection of both 'successful' and 'unsuccessful' product innovations as aids to explanation of product development, adoption and diffusion. However, it was not possible to use this framework for the GLEB technology initiative. To follow through the success or otherwise of a particular product or project was problematic because the extent of product innovation (and demand or need-pull) that would emerge from the Networks at this early stage of development was uncertain. There was not the benefit of hindsight from which many innovation studies are able to draw on. The innovation process and subsequent diffusion of products is a long-term activity. The innovation approach was not appropriate within the time constraints of the research project. In addition, the socially-useful element of potential product innovations meant that evaluation in purely commercial terms was not considered feasible.

The other strand of literature that related to the area of study was the social process of innovation discussed in Chapter Two. This perspective emphasised the importance of 'actors' (Callon 1980) and 'social groups' (Pinch and Bijker 1984) to the design and development of technologies. The concept of social group was used to define institutions and organisations as well as organised and unorganised individuals. In the same way, the concept of actors included the diverse groups of people influential to the development of a technology; technologists, scientists, users, manufacturers, government departments and so on. This work aims to investigate how technological artefacts are consciously or unconsciously designed to achieve objectives other than the purely technical or economic (see Noble 1979). Again, this approach relies on the existence of concrete product innovations around which the abilities of actors and social groups to shape the technology can be investigated. At a later stage some products did emerge from the Networks so that a research strategy of this kind may have been possible. However, at the time the decision was made to concentrate on the social processes of policy implementation within the Networks irrespective of whether particular products could provide a focal point.

Before discussing the research strategy in more detail it is worth mentioning another direction that the research could have taken. The technology policy formulated by the GLC and the GLEB placed great emphasis on the close connection between product design and development and social need. An approach to the research could have concentrated on the social need aspect. The main reason why this was not attempted was that, as discussed earlier (Chapter Two), the concept of social need is problematic and thus the possibility of formulating a useful definition that could be operational for the purposes of measurement seemed to be too large and uncertain an undertaking. An approach which sought to identify groups of users of the Networks and investigate their perceptions of social need (naturally subjective) may have been possible at a later stage in the Network's history. However, at the time of the research project one of the major tasks facing the staff in the Networks was the encouragement of participation. As part of their activities the Networks were involved in building their own constituencies, so that there was not a ready pool of user groups to form a representative sample or to set up a meaningful study of consumers. It seemed to be more sensible to concentrate on how the Network staff were approaching the problem of participation and socially-useful product design and development.

The uncertainty of policy outcomes for the technology initiative meant that the concentration on policy implementation processes was a reasonable way to proceed with the research. The Technology Networks were proposed as organisational establishments through which the technology policy could be implemented.

Two central propositions informed the Network approach to innovation:

first, that 'one of London's most precious assets is the skill, the ingenuity, the creativity and the sheer enthusiasm of its people', and second, 'London possesses in its three Universities and seven Polytechnics one of the richest scientific resources in the world' (GLC 1982).

For the purposes of the research the GLC technology policy is seen as a theory. This way of regarding policy formation is advocated by Majone (1975) who argues that: '.. policies are, in fact, tentative theories - about the nature of social processes and the working of social institutions....' (p.50). In a similar vein Hedberg and Jonsson (1977) argue that policy or theory acts to generate strategy and activity. If the strategy is seen as an hypothesis, subsequent action will test this hypothesis and thus verify or falsify the theory or policy. Guided by this approach to the understanding of policy implementation, the knowledge gained from the initial period of fieldwork at the GLEB was used to construct a tentative theory on which the technology policy initiative was based. The strategies of policy implementation were formed into working research hypotheses. The main value of this approach is that it offers the ability to construct an analytic framework that allows an evaluation of the GLC and the GLEB technology policy in their own terms. That is, were they able to achieve the objectives of their own policy formation?

4.7 RESEARCH HYPOTHESIS.

The central propositions for the Technology Networks described in 4.6 were the basis of the GLC socially-directed technology policy. The propositions implied, first, that if facilities were created for the design/development of socially-useful products, the people of London would use them. Second, links forged with Polytechnics and higher education institutions could tap their spare capacity in terms of time and technical resources.

The propositions led to the formulation of my research hypothesis:

User involvement in the selection, design specifications and development of products together with access to technical resources are the key components of a socially-useful technology policy.

This hypothesis turns the general research question of the study; 'how could a local authority generate a technolgy policy based on social need', into a proposition or statement that can be investigated. Propositions serve to guide the research endeavour by making the information sought more explicit. This is necessary to identify the relevant units of analysis and the best ways of tackling the data collection.

Operational definitions define more precisely the central concepts of the study. User involvement, access to technical resources and social-use were concepts identified during the first stage of the research, and used to denote certain aspects of the technology policy under investigation. By unpacking these concepts the central elements may be used as indicators or guide-posts for data-collection. In this way the link is made between concepts and empirical data, this enables an evaluation of the GLC/GLEB technology strategy through the investigation of the implementation process, that is, how the theory or policy worked out in practice.

4.8 INTERVIEW SCHEDULE.

The operational definitions of the central concepts were used to construct a semi-structured interview schedule (see Appendix One). The choice of a semi-structured interview technique was made out of a concern to explore the issues relatively freely with the respondents. The checklist of questions ensured that all interviews followed the same format, but within that the respondents were able to talk freely around central subjects. The interviewees' perceptions of their role, together with facts, opinions and insights were seen as important to responses.

At the time of the research the Networks were developing to different time-scales, and tended to emphasise different elements of the technology strategy. Some were concerned more with community involvement than product innovation, whilst others were concerned to emphasise product innovation. The strategy was being implemented in different ways and it was important to recognise both the diversity of function as well as the diversity of perceptions of the strategy. A structured interview technique would have meant that questions were precisely formulated and the choice of response pre-defined. This technique is more important for survey research where there is a need to collect data that is amenable to quantification. The data collected in the Networks was of a qualitative nature.

A complementary method to semi-structured interviewing could have been a period of participant observation in one of the Networks. Whilst the value of a combination of techniques for added reliability and validity of data collection is acknowledged, the decision was made not to attempt this. With hindsight, it could be argued that this represents a weakness in the data-collection methods. However, time constraints and the difficulties associated with participant observation at the PPU and at the Technology Division at the GLEB, acted to support the decision to proceed by interviewing. Interviewing allowed data-collection from specific people employed in the Networks where access to their time was pre-arranged. Within the time limits of the project this research method presented the means for data collection in all of the Networks. In this way the differences and similarities between them could be observed. At the time of interviewing direct observation techniques were also used to note the layout of the buildings, their accessibility and so on.

For the research the Technology Networks and Technet Limited in the Technology Division at the GLEB were defined as the relevant units of analysis. Within the research as a whole there was a concern to pay attention to both the micro or internal events in the Networks, and also to macro or external factors that affected policy implementation processes. It was important to locate the case-study of the GLC/GLEB technology policy in its political and economic context (see Chapter Three) because this was directly relevant to policy implementation processes and policy outcomes. The Technology Network study is discussed first, and then the investigation of the macro or external factors affecting the implementation process are discussed.

For the Technology Network study the co-ordinators of each Network were contacted, first by letter and then by telephone to arrange an interview. Those contacted were willing to give their time (apart from the co-ordinator of the London New Technology Network, in this case another member of staff was interviewed). The interviews were undertaken, each lasted approximately one and a half hours and notes were taken at the time. An effort was made to proceed in a conversational style so that interviewees talked freely around central issues in the interview schedule. Care was taken to listen and to follow up additional topics if they came up in conversation. In addition to the co-ordinators other individuals were interviewed if suggested by the co-ordinators themselves as being important in some way to the direction that the Network was taking (For a diagrammatic map of respondents see Appendix Two). The interview period was from November 1984 to February 1985 depending on when interviewees had the time. By this time, all the Networks were established and had been operational for at least a six-month period.

Interviews were also carried out with key personnel at SCEPTRE in Sheffield and UDAP in Coventry because these organisations were similar to the London Technology Networks. An element of comparative data from these organisations was thought to be useful for analysis of the research findings.

4.9 QUALITY OF THE RESEARCH DESIGN.

There are several ways to judge the quality of a research design (Yin 1984). First, is construct validity. In this project care was taken with the operationalisation of the concepts that formed the interview schedule. It was necessary that operational definitions would be immediately understandable to respondents. Information from the fieldwork at the PPU and the GLEB, and published documents from the GLEB on their Technology Network initiative were used to guide definitions. In this way, concepts and the questions emanating from them were understandable to respondents. Where possible checks on responses from the interviews were made with the documentary evidence available (Council minutes, GLEB and Network publications). Also the report of findings, in draft form, was sent to respondents for their comments.

A second aspect of the quality of research design is external validity. The nature of the concepts and operational definitions ensured that the findings from the data collection could be linked to the GLC/GLEB technology policy or theory. Thus the information was internally generalisable. The use of comparative data from Sheffield and the West Midlands, and a search for comparative cases in the secondary source literature added to the ability to relate the case-study findings to theory.

Third, the reliability of the data collected was aided by checks with documentary evidence from the GLC/GLEB and the use of secondary source literature in the form of articles in academic journals, newspaper reports and so on. With the publications, particularly those published by the GLC and GLEB, potential organisational bias was acknowledged. However, the objective of the investigation was to include different perceptions of the technology policy so that this did not matter to a large extent. The bias could be acknowledged but seen as an element of the research itself. With the use of documentary evidence and secondary source reportage the point was to converge on the same set of events from as wide a range of perspectives as possible. Thus throughout the time of the research project care was taken to collect published material on the events at the GLC/GLEB and the Technology Networks from newspapers and journals. These were regularly scanned in The Open University library and additional material was collected from visits to the Information Division at the GLEB. It was taken into account that bias and accuracy of reportage are elements present in published material. However, their use was to corroborate and augment evidence from other sources. When reviewing documents and secondary source literature it was borne in mind that the material was written for a particular audience and was concerned to achieve certain objectives. An attempt was made to avoid being mis-led by trying to identify why the material was written and for what audience. This helped with the interpretation of the contents of the material and with the aim of being as correctly critical as possible.

4.10 ANALYTIC FRAMEWORK.

The analysis of the case-study findings relates to the initial research questions. The data collected from the Technology Networks was collated under the concept headings of user involvement, access to technical resources and social use. The findings are presented in Chapter Six.

A deductive form of explanation (The Open University 1981) was used to relate findings to the initial research questions and verify or falsify the GLC/GLEB technology policy or theory. The evaluation rested on whether the Technology Networks achieved the objectives set out in the initial policy statement;

a) user involvement in product design,
b) technology transfer between the Polytechnics, Networks and the community,

c) innovation of socially-useful products.

As mentioned earlier the Networks developed in different ways and emphasised different parts of the strategy, thus evaluation under these headings was in the Networks own terms. One of the difficulties of a more objective measurement lies in the intangible nature of the output from social organisations like the Technology Networks. Additional data relating to the implementation process was collated under the headings of the analytic framework described below.

As the data was being gathered there was a concern to link the micro-analysis of the policy implementation process in the Technology Networks to macro or external factors affecting the policy implementation process. It was clear that the working of the policy could not be understood without setting it in the context of the wider political and economic environment. Thus the periods of fieldwork already discussed were supported by library searches for available literature pertinent to the area of study - the nature of central/local government relations, the economic policy initiatives of the other 'radical' councils; Sheffield and the West Midlands (see Chapter Three). In this way, fieldwork and literature analysis proceeded hand in hand. Relevant literature analysis was also important for the analytic stage of the project.

An analytic framework for policy implementation processes is suggested by Thain (1987), this framework includes the following elements:

1. Background to policy - the historical, economic and political context of the policy formation.

2. Policy implementers - the agencies involved in the policy process.

3. Policy aims and objectives.

4. Social influences on policy implementation.

5. Economic influences on policy implementation.

6. Political influences on policy implementation.

This analytic framework was used as a guideline in this research to collate the information from fieldwork and from secondary source analysis. The framework allowed attention to be paid to both internal and external factors affecting the policy implementation process. Thus the data collected was collated as follows:

1. Background to policy - findings from the initial pilot study phase of fieldwork at the PPU and the GLEB, presented in Chapter Five.

2. Agencies involved in the policy process - study of the Technology Networks, findings presented in Chapter Six.

3. Stated and perceived objectives of the policy - GLEB/GLC documentary analysis and the technology network study.

4. External constraints on the policy - these involve the wider social, political and economic factors that have an impact on implementation.

The data collection for the latter area of the research relied on secondary sources (although the perceptions of the interviewees were included where relevant). Much of this material is presented in Chapters One and Two, the literature survey on the innovation process and the social shaping of technology. In addition, published material directly related to the societal context of the GLC is presented in Chapter Three as the setting for the research. This material is drawn on in the analytic stage of the research project to assist with explanation-building,(see Chapters Seven and Eight). As mentioned earlier, with the use of secondary sources care was taken to be correctly critical.

Throughout the research project the aim was to ensure an on-going process between ideas generated by the area of study and theoretical concerns of innovation and technological change. In this way it was possible to continually refine ideas, and make the wider significance of the study and its relation to theory understandable. Ideas tended to be investigated and refined by a process of writing draft chapters that were commented on by a number of people at The Open University and at other academic institutions.

For the interpretation and analysis of findings two methods of explanation are employed - deductive and inductive (The Open University 1981). Interpretation of the Technology Network study proceeds deductively, that is, from the general policy objectives to the evaluation of specific hypotheses by observation. The relation of empirical work to theory proceeds inductively, that is from observation to empirical generalisation to theory.

The next stage of the analysis consisted of constructing interim policy outcomes - what did the Networks achieve and how did this compare to the initial policy statement. Here note was taken of what the initiative did achieve as well as what it did not.

The next step was to construct a valid explanation of why this was the case. Explanation-building of this form proceeds inductively. The comparative data collected from Sheffield and the West Midlands was compared to the findings from the Network study. This enabled a distinction to be made between general problems of the technology policy approach (other cases were similar) and those that were specific to the GLC/GLEB initiative.

This process of refinement and comparison for explanation building is advocated by Yin (1984). The comparison of similar cases discovered through secondary source analysis offers additional information for the generation of explanation. In this way it becomes possible to offer an explanation as to how a local authority can generate a technology policy that is based on social need.

Attention to the larger question of what the case-study reveals about why certain technologies are designed/developed and others are not requires an investigation of the external constraints identified from fieldwork and secondary source analysis. This involves a process of returning to the background context of the GLC, for example, investigation of the limitations of a local authority's sphere of influence and how this affects its potential as an agent of technolgical change. The relation of findings to this larger question is an exploratory exercise offering possible explanations and the suggestion of hypotheses for further research. The theoretical concerns about the nature of the innovation process and the social shaping of technology aid this process. This forms the content of Chapter Eight.

The analysis stage of the project sought to link the GLC/GLEB study with the theoretical concerns of technological change. The conclusions of the study and the end-result of the research, presented in Chapter Nine, suggest certain priorities for resource allocation by local authorities concerned to achieve socially-directed technology policy objectives.

CHAPTER FIVE: THE GLC INDUSTRY AND EMPLOYMENT INITIATIVE.

5.1 INTRODUCTION.

In this chapter the main points of the Greater London Council (GLC) Industry and Employment policy are described. The information was collected during the early stages of fieldwork carried out at the Popular Planning Unit (PPU) at the GLC and the Greater London Enterprise Board (GLEB). Discussion of the initiative follows a brief historical outline of the strands of thought which emerged within left-wing politics during the 1970s. The resurgence of local socialism, the Labour Party Programme of 1973, workers plans and community planning are discussed in relation to the GLC policy initiative. It is important to draw attention to these movements and the way that they influenced the policy initiative.

First, a discussion of Labour and the local state clarifies why local government was seen as an arena of potential socialist advance. This is relevant because it indicates that there has always been conflict and change at the local level throughout the history of local government (Chapter Three described the form this conflict has taken during the 1980s). Second, the Labour Party Programme for Industry of

1973 is discussed because there are clear parallels with the type of policy initiative attempted by the GLC. The benefit here is of historical insight, called upon in the discussion of the policy initiative. Third, workers' plans and community planning, which may be seen as culturally familiar activities to the 1970s, were directly relevant to the GLC 'grassroots' approach to local politics. What emerges from this review is a picture of an attempt by the Labour controlled GLC to link together a number of political concerns and perspectives which developed independently, and in quite different contexts, within their overall approach to economic development. The distinctly different cultural and social patterns of the 1970s and 1980s, generally subsumed under the headings of group activity and individualism, respectively, have had important consequences for the GLC policy initiative. These are discussed more fully in Chapter Seven.

5.2 LABOUR AND THE LOCAL STATE.

Labour Party involvement in local government has a long history dating back to the formation of the Labour Party in 1906. However, the establishment of a Local Government sub-committee on the National Executive Committee in 1932 1982?

was the first attempt by the Party to co-ordinate activities at a local level (Gyford 1985).

Within the labour movement there are identifiable themes which have moulded views on the nature and role of local government. First, municipal socialism as advocated by the Fabian movement. This was laid out in the Webbs' 'Constitution for a Socialist Commonwealth' published in 1920. In this document it was envisaged that, ultimately, most of industry would be administered and controlled at the local level (Bassett 1984). The practical application of this tradition was developed by Herbert Morrison, albeit in a more limited way, during his years on Hackney Council and the London County Council in the 1920's and 1930's (Donoughue and Jones 1973). Morrison wrote extensively on local government and socialism and was in favour of gaining popular support for incremental municipal control and reform, within the confines of the statutory powers of local government. This was a view shared by the central Labour Party; incremental reformism through state institutions would build the road to socialism. MacIntyre (1980a) notes that this perspective was based on the view of the state as dominated by a capitalist class, but not an inherently class-based institution. Thus it was open to take-over by a socialist majority to be used for the benefit of the community.

The Morrisonian tradition of reformism through the state was in contrast to the activities of the more militant localities such as Poplar and the Little Moscows in the 1920's and 1930's (MacIntyre 1980b). These Councils were more concerned to advance socialism at the local level by direct challenges to central government, as noted in Chapter Three. Morrison felt that this undermined the image of Labour councils as sound and efficient alternatives to Tory ones (Donoughue and Jones 1973).

In the post-war period local government was relegated to a more passive role as the Labour Party emphasised central government as the road to socialism (Bassett 1984).

It is since the late 1960s, with the growth of community activism, that local government and local socialism have begun to re-emerge. This may be seen most clearly in the development of the representational role of local government. In other words, its role in the interpretation of how society works and why (Duncan and Goodwin 1985). The development of its representational role was particularly evident in the policies of the radical local councils discussed in this project. In part, this can be attributed to theoretical developments on the nature of local government.

'... the consciousness of the great mass of working people is around local issues. Consequently, the concept of the 'local state' highlights at one and the same time the nature and power of the state in our society and the importance of organising class struggle around state issues in the locality'. (Corrigan 1979 p204)

The Marxist perspective of local government and its potential for the advancement of socialism introduced the concept of the 'local state'. Theoretical analysis of this concept grew out of the empirical studies of inner-city deprivation, funded by central and local government, under the Community Development Projects scheme set up in the late 1960s and early 1970s (Corrigan 1979). The findings of these studies suggested that the preoccupation within local government with welfare services blinded it to the industrial restructuring which was affecting the whole context of the local economy. The focus of attention for the local authority should include local industry and the economy (Benington 1986).

In addition, much debate followed the publication of Cockburn's (1977) book, entitled 'The Local State'. Cockburn presented a case-study of Lambeth Council and implied that the local state operated in the interests of capital, thus its potential as a base for political action was limited. Cockburn emphasised community activism as the base for historical change. However, the functionalist account of the state in Cockburn's analysis has been criticised by Saunders (1980) as a crude interpretation. He argues that the autonomy of the local state differs over time and between localities. In relation to the radical local authorities, the slogan 'restructuring for labour' indicates their concern to act in the interests of labour and the local community, however, the ability to ensure this autonomy from the interests of capital within the context of the local economy was limited (see 5.12).

Further work portrays the local state as both agent and obstacle to change. A view that led to Dearlove's identification of the 'problem' of local government; '... local government is especially vulnerable to working class demands, pressures and even control' (Dearlove 1979 p244-5).

In 'In and Against the State' (London Edinburgh Weekend Return Group 1979), the authors acknowledge this contradictory nature of the local state. On the one hand as provider of services, but on the other, provision in a way that fragments and distorts problems for client groups. This Group argued, therefore, that political struggles need to address problems of the social relations, that is, who controls and governs, implicit in the state as well as the more practical problems relating to adequate service provision. Despite disagreement among commentators on the nature and role of local government, this theoretical analysis has contributed to its re-emergence as an arena for political struggle, particularly in relation to the attempts by the Thatcher Government to erode the autonomy of local government, as discussed in Chapter Three.

In many cases the struggles around the state on issues of service provision have involved women, for example, services that relate to the family, housing, childcare and so on. The women's movement has been influential in the development of anti-hierarchical and participatory forms of political activity through the practical experience of struggle. Practical experience coupled with the theoretical analysis of the state, is the basis of what may be termed 'prefigurative politics' (Rowbotham, Segal and Wainwright 1979). This political perspective incorporates the view that political struggle and the forms of social organisation that arise from them should contain elements of future socialist solutions. In other words, tackle the social relations implicit in struggles around service provision by having a sense of the future direction and change that is aimed for. This denotes an offensive, rather than defensive political strategy.

The perspective of pre-figurative politics played a large role in the GLC strategy, particularly in the area of popular planning. In this way the GLC attempted to capitalise on its representational role and demonstrate a political alternative to Thatcherism (Duncan and Goodwin 1985). The strategy of pre-figurative politics was seen as crucial to future social change. Thus some elements of the radical economic initiatives were designed as political and ideological pilot schemes; that is, they were not expected to be 'effective' in their own terms but to prefigure some future goal.

A further influence on the radical economic initiatives has been the critiques of Keynesian demand-management by the Conference of Socialist Economists (C.S.E.). This group focused theoretical attention on the sphere of production, the restructuring of the manufacturing sector, changes in the labour process and the role of the state (Benington 1986). The Chief Economic Adviser at the GLC was Robin Murray, a key figure in the C.S.E. Group. The sector studies which formed the base of the London Industrial Strategy (LIS) drew on this school of political economy (Bennington 1986).

The renewed interest in the role of local government as an arena of socialist advance has been subject to debate at the level of the national Labour Party with the development of the Alternative Economic Strategy (AES) (Labour Co-ordinating Committee 1980). As a national strategy for growth, employment and the social control of industry the AES built on the Labour Party Programme of 1973, and assigned local democracy and community mobilisation central roles. The AES contained proposals for the reduction of central controls for local councils and the search for new sources of local finance. The development of community plans was central to ensure a grassroots democratic base for the AES. The local plan would involve a more active and interventionist role for the local council through the establishment of local planning agreements with firms in the locality, support for co-operative enterprises and the tapping of pension funds for municipal investment (Ibid.). Although the AES aroused much criticism and debate from within the Labour Party it put the role of local council's onto Labour's national political agenda.

This role has continued to be developed through the period of the research, and has been influenced by developments at the GLC and, more especially, around the creation of the GLEB. For example, the 1986 Charter for Local Enterprise included proposals for a national network of Local Enterprise Boards. The National Executive's Committee statement to the 1986 Labour Party Conference spelt out their proposals as follows:

'Labour will work through enterprise boards and other agencies and where appropriate, directly through local authorities, to support industrial development in a variety of new and innovative ways. They will be encouraged to:

- provide funds for investment in return for equity shares. In this way Local and Regional Enterprise Boards will be able to take an active role in shaping the development of local industry instead of merely acting as passive money lenders.

- extend their support beyond finance to include business advice, assistance with finding property, funding of R&D and training.

- support further expansion of workers' co-operatives - where workers have a genuine say over the strategy the company pursues and the way it is run.

- encourage the development of community industry by providing finance, premises and management services.

- develop research links with local polytechnics and universities to set up 'tech-nets' (information exchange systems for new products and process technology).

- provide financial and technical assistance to people wishing to go into business but usually not viewed with sympathy by banks and other financial institutions - notably, redundant workers, women and ethnic minorities (quoted in Mole and Elliott 1987 p.121).

This brief history of the attitude to local government in the Labour Party, and which has particularly captured the minds of the Labour Left demonstrates the combination of influences central to the emergence of local socialism; municipal enterprise, participatory democracy and pre-figurative politics.

5.3 LABOUR PARTY PROGRAMME FOR INDUSTRY.

At the beginning of the 1970s the major concern for politicians and economists alike was industrial decline and the collapse of the manufacturing sector (Moore and Rhodes 1976). The Labour Party in opposition devised a policy for the regeneration of British industry. The proposals included the creation of a National Enterprise Board (NEB) and a planning agreement system to act as instruments of positive public intervention and planning in the private sector. It was envisaged that the NEB would act as a state-holding company for existing state shareholdings, and in addition, take over some twenty-five of the hundred largest companies in Britain. This would give it significant leverage to influence the direction of the economy as a whole.

In conjunction with the NEB a comprehensive system of planning agreements between the government and all large firms, especially the top one hundred, was proposed, with sanctions against those refusing to co-operate (Labour Party 1973, Holland 1975). The Programme also included measures to increase industrial democracy in nationalised industries. Through the NEB and planning agreements, shop-floor based democracy, organised through trade-union channels, would be created (Coventry et al. Trades Councils 1980).

As the Labour Party moved from opposition to office the potentially wide-ranging measures of the Labour Party Programme (Labour Party 1973) were curtailed. The 1974 Labour Government's Industrial Strategy was launched at a meeting of the National Economic Development Council (NEDC) in November 1975. The NEDC; a tripartite body comprising the government, the Confederation of British Industry (CBI) and the Trades Union Congress (TUC), agreed to the publication of a White Paper 'An Approach to Industrial Strategy' (1975) as the basis for future work. This White Paper laid the foundations for the Industry Act of 1975, the chief objective of which was the establishment of the NEB. The NEB was to provide financial assistance to companies in key sectors. Another measure proposed in the White Paper was an investigation of the constructive use of public purchasing policies to develop the export potential of appropriate industries (An Approach to Industrial Strategy 1975).

The initial White Paper was published in August 1974 and the Industry Bill appeared at the start of 1975, both while Mr.Benn was Secretary of State for Industry. The Industry Act 1975 established the NEB, created powers for the Secretary of State to prevent or reverse the overseas ownership of manufacturing enterprises and provided for the disclosure of information on manufacturing enterprises to ministers and trade unions.

The 1975 Act also gave statutory recognition to planning agreements. These were voluntary agreements between an enterprise and the government concerning the strategic plans of the enterprise over a specified period. Consultation with the relevant unions was intended to be part of the process of drawing up a planning agreement, if necessary making use of the 1975 Act's provision for disclosure of information (Devine et al. 1985).

From spring 1974 to summer 1975, the Department of Industry, under Benn, began to implement an interventionist strategy that was not only based on commercial criteria but which showed consideration for social factors, such as employment needs, as a basis for aid to industry. In particular, financial assistance was provided to five firms although the Industrial Development Advisory Board had advised against it - in three cases to workers co-operatives looking to rescue jobs (for example, the Scottish Daily News) after the original firms had collapsed. However, after the defeat of the Left in the June 1975 EEC referendum Benn was replaced as Secretary of State for Industry and transferred to the Department of Energy (see Stewart 1977). The Industry Act, which differed from the Bill, was passed in November 1975 after Benn had left the Department of Industry.

At the beginning of 1976, the Department of Industry published its Criteria for Assistance to Industry. A basic principle was that the cost of assistance to enable an enterprise to become viable ie. profitable, had to be weighed against any relevant social considerations including employment, balance of payments, rationalisation, research, and sectors of industry of special significance to the economy (Department of Industry 1976). Draft guidelines for the NEB were published in March 1976 and the final guidelines in December 1976. In the end the NEB was required to operate to commercial criteria, denied compulsory powers and permitted to acquire majority shareholdings in firms only with their consent. The role of planning agreements was also downgraded, for example, it took fifteen months to conclude the first one, in March 1977, with Chrysler UK. The irrelevance of this planning agreement was demonstrated in 1978 when the parent company reached an agreement to sell its European operations, including Chrysler UK, to Peugeot-Citroen, without bothering to discuss the matter with the UK government (Devine et al. 1985).

The other route of financial assistance was through general and sectoral schemes; the purpose of which were to promote investment in general and to stimulate investment, modernisation, efficiency and rationalisation in specific industries considered to be of particular national importance. The Government's Industrial Strategy involved the creation of Sector Working Parties (SWP's). Their work involved three stages. First, the NEDC would identify the industries or sectors that it considered to be the most important for the achievement of the Government's Industrial Strategy objectives. Once completed the SWP's would undertake detailed analyses of the particular problems and possibilities of their industry or sector and recommend appropriate action. Finally the findings of the detailed SWP analyses would be collated as a basis for general discussion. The aim of this approach to industrial strategy was to stimulate discussion and action at industry level and, in addition, to feed information upwards to help the government to assess its policies and determine its priorities. By the end of March 1979 fourteen sectoral schemes had been instituted covering: wool, textiles, machine tools, clothing, footwear, ferrous foundry and others (Devine et al. 1985).

Davies et al (1980) found that in 1975/6 state aid was primarily of the supportive rather than the picking winners type. Although rescue operations claimed the most publicity they were never envisaged as the main purpose for which selective assistance was provided. By 1977 this had begun to change, it was estimated that financial assistance was about evenly distributed between rescues and schemes, with rescues becoming less and schemes becoming more important (Department of Industry,1977).

The Labour Government created the tools for large-scale economic intervention, along the lines of Fabian social reformism (see McBriar 1962, Sancton 1976). However, these tools were never used to their full potential. The NEB did not have sufficient funds to significantly affect public ownership, and planning agreements were largely left unexplored. Two problems emerged from the strategy, first should criteria for intervention support or supplant market forces ? And second, how were implementation and monitoring to be achieved ? Although the Government formulated the Industrial Strategy, implementation rested largely on management and unions, with the attendant problems of ensuring the translation of analysis into action at the level of the firm (Young with Lowe 1974).

A number of Sector Working Parties reported that within firms, management were reluctant to work jointly with union representatives and often information was not circulated. Joint planning, if attempted at all, between management and unions was largely a process of worker consultation arrangements that were popular in the 1970s as a response to job-enrichment programmes. Consultation was around a pre-defined agenda set by management, discussion of work patterns, job control and job security remained a management prerogative.

Central to the idea of industrial democracy is trade union influence over the higher levels of industrial decision-making; long-term investment, product development and diversification, productivity targets and so on. This raises the issue of managerial control. An issue which attracted a great deal of controversy following the publication of the Bullock Report (Committee of Inquiry on Industrial Democracy 1977). Employers argued that a merging of management and union roles would lead to greater inefficiencies. Unions argued against the imposition of democracy through legislation; democracy must grow through political battles on the shop-floor. Worker representation alongside conventional collective bargaining would be unworkable. Collective bargaining should be extended to include company board-level decisions but this would be incompatible with participation in the form of worker-directors (Coventry et al. Trades Councils 1980).

The left-wing of the Labour Party prescribed a democratic base for industrial policy. This involved mechanisms for the democratic determination of priorities for resource allocation, the development of a framework to ensure the social accountabilty of enterprises, and the involvement of workers in running their place of work. The 1972-4 Labour Party policy of NEB control of twenty or so of the largest companies, planning agreements and industrial democracy was an attempt to achieve this. At that time the strength of forces committed to the status quo was great enough to prevent the implementation of the policy (Watson 1977).

However, the main elements of the Industrial Strategy reappeared in the Industry and Employment policy developed by the GLC - the creation of the GLEB, enterprise planning, sector strategy planning were all present in the GLC initiative and mixed with influences from outside mainstream party politics.

5.4 WORKERS PLANS.

The attempt by the Labour Party in the 1970s to base an industrial strategy on the premise of industrial democracy discussed above was matched by attempts to develop democratic planning outside of mainstream politics. The promotion of industrial democracy through the Bullock Report (Committee of Inquiry into Industrial Democracy 1977) foundered on the limitations of governmental influence over economic activity at the level of the individual enterprise and the lack of support from trade unions for legislated democracy. Planning from above required, for implementation, an equally weighted initiative of planning from below. The GLC Industry and Employment policy acknowledged the need for popular democratic support for policy initiatives and were concerned to stimulate a process of worker and community planning.

Workers' plans began to emerge in the mid-1970's encouraged by Benn while he was the Secretary of State for Industry.

The shop stewards' movement established shop stewards' committees, often multi-union, multi-plant, and sometimes multi-company, to work on policy proposals for their companies and industries which could become part of Labour's planning agreement procedure. These initiatives included Lucas Aerospace, Power Engineering Industry Trade Union Committee, Dunlop, Scotch Whisky Combine, Metal Box, Thorn, and other Combines; Joint Stewards' committees in the car and machine tool industries (George 1983). Perhaps the most important of these plans ,in terms of the GLC strategy, and certainly the most publicised, was the Lucas Plan (Wainwright and Elliott 1982).

In 1976, shop stewards' working at the Lucas Aerospace Division of Lucas Industries published an 'Alternative Corporate Plan'. The Plan included detailed proposals for 'socially-useful products' which could be made by the workforce, as alternatives to arms production, and which would stem the tide of redundancies at Lucas Aerospace. The Lucas Plan proposed 150 products in all, mainly in the areas of energy, transport and medicine, these included gas-fired heat pumps, a hybrid road/rail bus and improved kidney machines.

Product proposals were developed through a system of site project teams. Shop stewards on each site were concerned to develop ideas for socially-useful products that built on the existing skill, expertise and knowledge of product development among the workforce. The technical resources within Lucas Aerospace in the form of equipment and services were taken into account for product planning. In addition, an attempt was made to link product proposals to social needs through discussions with community groups (Wainwright and Elliott 1982).

The Lucas Plan represented an offensive strategy against unemployment. It put the idea of socially-useful products on the technological agenda, particularly in the field of renewable energy. And importantly, was a concrete example of the effectiveness of worker involvement in product development. In some cases, product prototypes were developed by sympathetic researchers in Polytechnics, and some product ideas have been developed, but not by Lucas Industries.

Wainwright and Elliott (1982) monitored the developments surrounding the Lucas Plan and related how the management at Lucas Aerospace were obstructive and hostile to it. After some years of struggle the Plan was marginalised and several key shop stewards were dismissed.

Several of the sacked shop stewards subsequently found employment with the radical local authorities in Britain, many of their ideas were used as a basis for an alternative technology policy. Mike Cooley, a leading member of the Lucas Aerospace Combine Shop Stewards' Committee, joined the Economic Policy Group (EPG) at the GLC, and later became Director of the Technology Division of the Greater London Enterprise Board (GLEB). Thus in many ways the Lucas Plan was the progenitor of the sort of approach to innovation developed by the GLC (Mole and Elliott 1987).

5.5 POPULAR PLANNING.

The democratic approach to product planning exemplifed by the Lucas Plan and the creation of alternative policies for unemployment was also applied by community organisations during this same period. Activities in the community centred around trades councils and between 1978 and 1980 the trades councils and the stewards' committees published a booklet called 'Popular Planning for Social Need (George 1983). It called for an economic and industrial strategy based on alternative policies for jobs, housing and other areas of perceived social need. Their view was that economic and industrial planning must be based on activism at the grassroots, on concepts such as 'socially-useful production' and geared toward the allocation of resources to unmet needs (George 1983).

The planning responsibilities of local authorities include structure plans and local plans. Structure plans are development plans and cover a period of twenty to thirty years, that is , they are long-term plans. Elements of these plans include both the physical and economic aspects for an area, such as, land use, employment needs, recreational facilities and so on. The structure plan comprises the overall policy. Thus, the London Industrial Strategy (GLC 1985) formulated by the GLC and discussed below, represents this form of local authority planning. Local plans involve borough council areas and provide for more detailed provision, the idea is that they feed into and co-ordinate with the structure plans. The GLC, via the Popular Planning Unit, were concerned to encourage popular participation in the formulation and development of local plans, thus the Docklands Plan (discussed below) would feed into the London Industrial Strategy (GLC 1985).

Participation in local planning has been part of the local political agenda since 1968. A statutory obligation for local authorities under the Town and Country Planning Act, 1968, was public consultation over structure planning. The Skeffington Report (1968) sought to advise on the best methods for participation, such as publicity, that would resolve problems of implementation of local authority planning. The purpose of participation initiatives was to secure a problem free implementation stage and participation initiatives usually took the form of consultative strategies, such as ,public meetings, once the plans had already been drawn up. However provisions for participation, albeit partial, do not necessarily lead to public involvement. It was found that middle-class, more affluent groups with a history of participation in resident associations and other local and issue based organisations were more likely to take up opportunities for participation in planning than were the more working class groups (Cockburn 1977).

The Community Development Projects set up by the Labour Government in 1969 represented the official initiative that would ensure working-class involvement in community affairs. Each of the twelve Community Development Projects had a local action team run from a neighbourhood office. Local team operations comprised several elements; assessment of needs, the stimulation of local residents to take responsibility for their needs, organisational innovations, such as self-help groups, that would involve both community groups and the local authority (Cockburn 1977). Many of the project teams found that the experience of urban deprivation did not hinge on the activities of the local people, rather these social problems were symptoms of the inequalities of the distribution of power and resources in society (Corrigan 1979). Thus the focus for change was not the local population but the centres of organised power. For the community this involved a process of activism and consciousness-raising around issues affecting their lives (Cockburn 1977).

The popular planning initiatives in the GLC programme were a legacy from community action. As one commentator noted;

'Local politics (was seen) as a process of constant campaigning and mobilisation rather than simply a process of service delivery'(Gyford 1985).

The need was to facilitate, stimulate and build local initiatives. Hilary Wainwright, the Director of the Popular Planning Unit at the GLC described the Unit as:

'...generally an educator and sort of mobiliser, the Unit cannot deliver the goods in the sense of actually getting plans implemented. The idea is to bargain for plans, fight for plans and bits of these plans will be implemented. It is a strategy for opposition and a strategy for resistance rather than a strategy that assumes power although it has got implications for how power would be used'(Wainwright 1983).

The idea mirrored the Lucas Plan in that the strategy was offensive. The prefigurative element of local politics was particularly advocated in this Unit. Popular planning meant to actually draw up and prefigure plans for the community that included both industrial strategy and service provision (Rowbotham,Segal and Wainwright 1979). For example, the heating campaign 'Jobs From Warmth (GLC 1983) sought to build alliances between a number of different groups around the issue; trades council and trade union groups, women's groups, tenants organisations, unemployed workers, users and so on.

As discussed in 5.2 prefigurative politics and a federal organisational structure as a framework for action and change has been greatly influenced by the women's movement. Critical of traditional strategies for socialism, new ways of organising the struggle which explicitly express aims and objectives that have a utopian element have been developed. Women's groups have also sought to integrate their demands with the concerns of other groups, for example, demands for more nurseries and child-care centres require a shift in expenditure from defence to health and education, which is also a concern for peace groups and environment groups (Rowbotham, Segal and Wainwright 1979). The strategy adopted in the Popular Planning Unit was to encourage these forms of organisation in order to precipitate change based on the needs articulated by the local community.

5.6 THE GLC INDUSTRY AND EMPLOYMENT STRATEGY.

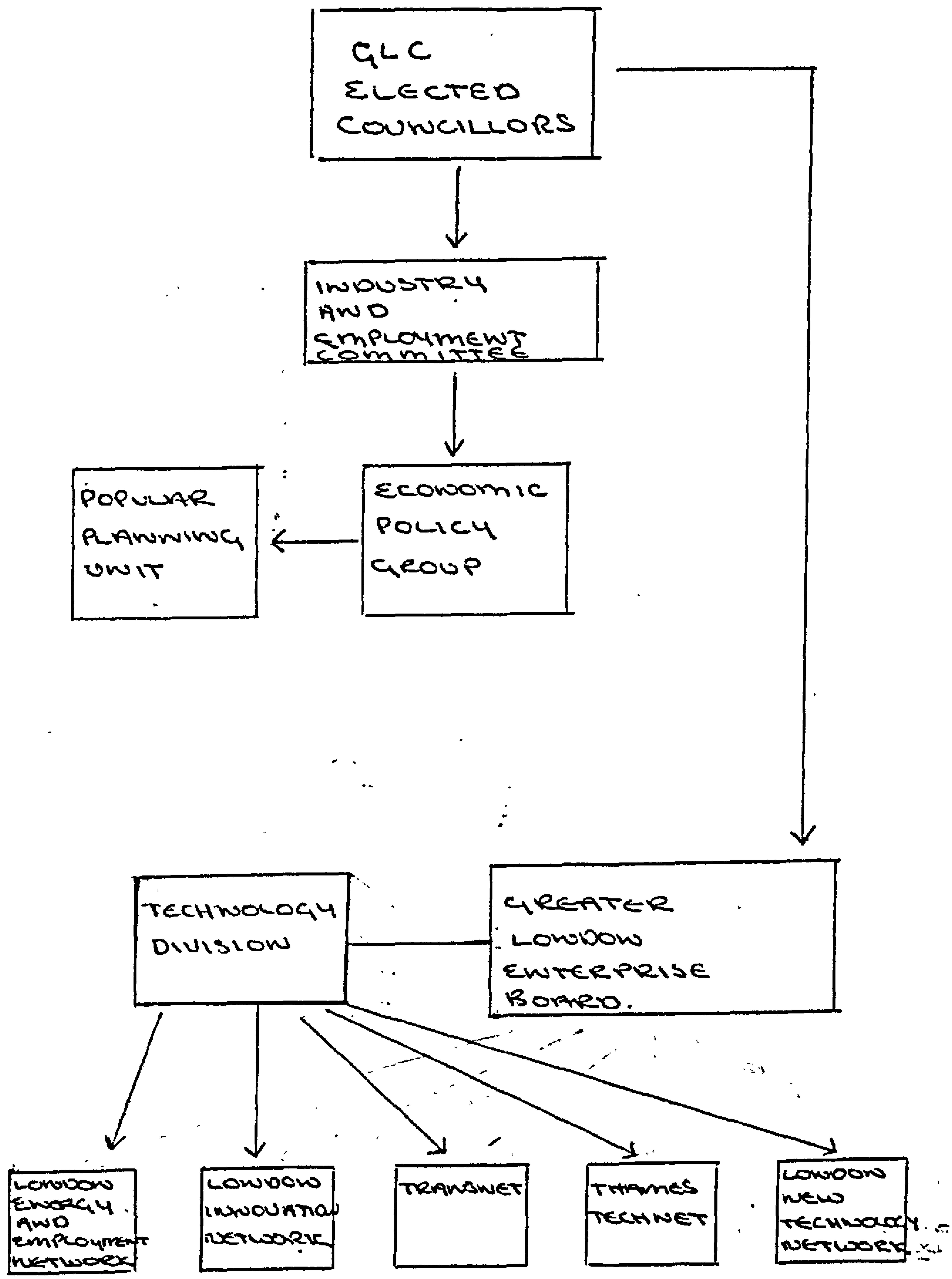
The influences that have helped to shape the GLC initiative point to the creation of facilities to support the democratisation of working and community life, hence the term 'restructuring for labour', which has been applied to this form of policy initiative (Goodwin and Duncan 1986).

The elements of the GLC Industry and Employment policy include: first, following the Labour Party Programme 1973, an interventionist strategy based on the identification of enterprises and industrial sectors important to the social and econonic processes of the local economy. This element of the economic strategy has been supported by the creation of an Economic Policy Group (EPG) to undertake sectoral analyses and indicate priorities for investment in a similar way to the Sector Working Parties discussed in 5.3. A second organisational innovation was the creation of the Greater London Enterprise Board (GLEB); a public investment company. Third, mechanisms, such as, planning agreements to support the position of workers, and the achievement of further objectives such as, equal opportunites. Fourth, the encouragement of worker co-operatives and alternatives forms of production exemplified by The Lucas Plan. And finally, the democratisation of local community planning and local economic management through the creation of the Popular Planning Unit (PPU).

The Industry and Employment policy of the GLC comprises these main elements, the following discussion concentrates on the organisational innovations of the EPG, GLEB and PPU because they represent the major strands of the policy. (SEE FIGURE 3.)

The Units established by the GLC Industry and Employment Committee and EPG were:

FIGURE 3



OUTLINE OF AGENCIES RELEVANT TO THE RESEARCH.

The Popular Planning Unit were concerned to help trade unions and local communities develop plans for different sectors and areas of industry and employment, and to advance their realisation through campaigns, propaganda and education.

The Project Development Unit's brief was to provide and monitor funds for decentralised locally-based agencies, including Co-operative Development Agencies, to further projects on employment issues aimed specifically at the unemployed, the disabled, ethnic minorities and women.

The Industrial Development Unit assisted trade unionists to understand industrial developments and corporate planning, particularly where their own companies were concerned, so that advance warning of threats to employment could be made.

The Contract Compliance Unit was responsible for ensuring that the GLC purchasing power was used for the benefit of Londoners and under conditions that improved working lives, including the assurance of equal opportunities for women, ethnic minorities and the disabled.

The Property Register and Housing Unit worked with the GLC valuer and the GLEB Property Unit to maintain a computer based register and to support modernisation and development schemes for London's run down industrial properties.

The Greater London Training Board was given the overall responsibility for Industrial Training in London, with the aid of a Training Board Support Unit.

An Employment and Welfare Unit was designed to coordinate work on employment, education and health issues, that fell outside the scope of GLEB.

In addition, policies for specific industries, sectors and areas were developed by individuals and teams in the Industry Unit, the Cultural Industries Unit, Infrastructure and Areas Unit and the Financial Institutions Unit (Barratt-Brown 1985).

5.7 THE ECONOMIC POLICY GROUP (EPG).

The creation of the EPG in March 1982 was an organisational innovation within local government bureaucracy. Officers were appointed who were sympathetic to the GLC programme and who could work closely with elected members of the Council on the formation of the industry and employment policy. The EPG acted as an advisory group to the Council. They were concerned with the structure plan for the Greater London area, which was published as the London Industrial Strategy (LIS) by the GLC in 1985.

The London Industrial Strategy (GLC 1985) consisted of a series of strategy documents which covered specific industries like printing and retailing, and sector analyses such as Energy, Housing and so on. Specific papers and proposals were developed through a combination of documentary research and discussions with shop stewards and user groups, thus a form of economic democracy was seen as important to the formation of policy proposals. The LIS once published was seen as a discussion document, open to amendments and alterations. Policy proposals were concerned to build on the real concerns of working people over jobs and services. For example, the strategy document on Health care combined an analysis of the deep problems in the NHS in London with proposals for increasing pay and conditions for health service workers, and possible alternative directions for improved healthcare ie. the employment of alternative medicine practitioners (LIS, 1985).

For a map of the Units at the GLC and the Divisions at the GLEB that were relevant to the research see Figure 3.

5.8 POPULAR PLANNING UNIT (PPU).

The PPU were concerned to encourage and facilitate community and workplace planning through campaigning, propaganda and education. 'Jobs For A Change' was the name given to the strategy, publicised in a book of the same name (GLC 1983) and in a newspaper issued free to Londoners. To stimulate popular participation in local planning, several strategies were employed. First, a mailing list was drawn up to ensure that all interested groups received the newsletter and notification of meetings and so on. Second, a Popular Planning Assembly was formed to bring different groups together. However, this Assembly only ran for a few months as it did not gain the support or momentum hoped for it (Wainwright 1987). Third, a series of Adult Education Institute courses were developed around the issue of jobs and alternative planning. These activities were aimed at the establishment of an appropriate infrastructure of education, support and co-ordination for planning projects. Tutor hours with the AEI and WEA were arranged so that tutor-organisers could work with local groups on proposals for socially-useful employment. Once tutors were appointed, a series of public meetings were arranged to publicise popular planning and the resources available to help groups extend their campaigning and bargaining demands. The Unit was particularly concerned to build on initiatives rather than merely promote popular planning in general. The links with the GLEB enterprise planning were fostered to increase popular planning opportunities in the workplace.

Research and information facilities that could strengthen local organisations were also supported, for example, CAITS, the Greenwich Employment Resources Unit (GLC 1982)

Before discussing local planning, it is worth reiterating the main points of the PPU approach, so that their legacy to workers plans and prefigurative politics is made more explicit.

Popular planning is about matching unused resources; unemployed people, machinery and buildings with needs expressed by the community. For example, a 'Jobs from Warmth' campaign sought to demonstrate that by building alliances between tenants and building workers it becomes possible to understand the needs of both groups and find ways of meeting those needs and create employment at the same time. Hilary Wainwright , the Director of the Popular Planning Unit explained the approach:

'The idea of popular planning, or workers' plans, is building on ideas and demands that are already coming out of working class struggles - most struggles are based around needs. Popular planning is just articulating those in a more detailed way and beginning to show how these needs could be met. For example, you can say that a lot of the demands of the women's movement are around social needs. Popular planning will only build on that by helping to make some of the connections between needs and resources and people working with those resources more explicit. At the GLC, we are talking about jobs from childcare - the idea of investing in child care centres to create jobs to meet child care needs, and that is one way of creating useful jobs'.

'Alternative plans.... begin to reveal the kind of economy we are fighting for and begin to point to where we need to build alliances and connections'. (Wainwright 1983)

A brief discussion of the Docklands Plan highlights some of the problems that the Unit faced with the implementation of their policy. In the first instance, the GLC were involved in issues over which they had little or no direct power, in relation to the Docklands area this was because of the creation of the London Docklands Development Corporation (LDDC) by the Conservative Government in 1980, which took over the powers of the elected authority (see Chapter Three). The campaign against the LDDC proposal for a STOLport (a short take off and landing airport) began in May 1982. Residents were concerned about noise, safety issues and the prospects of job creation for local people by the development of the docklands area to the LDDC's plans. The Joint Docklands Action Group (JDAG) had been involved in campaigns against the dock closures for some years, for them, faced with this new prospect, the concern was to gain the support of politicians in the fight against the STOLport. In its first year of operation the PPU gave priority to the campaign. Commitments in the Labour manifesto before the GLC elections in 1981 had been made to designate the Docklands as a priority area with policies for jobs for local people, public housing and an improved transport system.

An amalgamation of the resources of the GLC with the local groups involved in the campaign ensured technical support from the GLC Scientific Services Branch, in the form of information on noise regulations, runway lengths and flight take-off patterns. The Public Inquiry into the STOLport was announced to begin in June 1983. The Campaign in conjunction with Newham Docklands Forum decided that a 'people's plan' for the Docklands area would strengthen and support the arguments that were opposed to the STOLport. Financial aid was gained from the PPU and Newham Council for a shopfront resource office to co-ordinate proposals for the people's plan. The GLC approved £14,000 for five staff over a five month period, staff were local people with detailed knowledge of the issues and needs of the area and the different community groups involved in the Plan. The Campaign sought to involve as many local people in the proposals for the Plan and solutions to the problems facing the Docklands area by door-to-door canvassing, neighbourhood meetings and a newsletter. The People's Plan focused on job creation through the match of local skills to local resources (Newham Docklands Forum and the GLC PPU 1983).

The LDDC objected to the presentation of the People's Plan at the Inquiry but the GLC had the power to insist, they were also able to assist with the legal costs so that the Campaign could employ its own lawyer. What the Campaign achieved was the ability for local people to formally present their opposition to the LDDC proposals at the Inquiry. Since then the struggle has continued, particularly over noise levels. The People's Plan Centre was refunded by Newham Council after the abolition of the GLC in 1986, though without any full-time workers.

Several potential problems emerged from the PPU involvement in the Docklands Plan. Despite formal equality the GLC had all the power in terms of funding the organisation and could easily have dominated the Plan's development. Thus there was the necessity to ensure the correct balance between a hands on and a supporting role or the popular planning approach would have been downgraded into a more consultative participation arrangement. In addition, there was political pressure on the PPU to demonstrate the effectiveness of their approach, at a meeting to launch the People's Plan there were disagreements over the publicity, with some local groups feeling that the GLC and the PPU were gaining the publicity for what had been an essentially on-going campaign against dock closure since before the GLC took office. Whilst the GLC had the financial resources to support the Campaign a fine balance was also needed between what was essentially prefigurative policies and what could be delivered. In addition, local opinion over the LDDC proposals was divided, some of the local residents were in favour of the LDDC feeling that more jobs would be created by the LDDC than by the alternative plan. Indeed the budget for the LDDC in 1985/6 was £73 million compared to the £2 million budget of the GLC and the GLEB (Macintosh and Wainwright 1987).

This example of the popular planning strategy points to the way that the GLC could act to facilitate local campaigns through the provision of resources and expertise, but the approach was not without its problems.

The popular planning strategy gained publicity through the Docklands Plan and other plans such as the Lewisham Energy Plan. Their role was overtly prefigurative and gained much success through the newsletter. As importantly, they achieved a cultural breakthrough with the 'Jobs For A Change' music festivals organised by the PPU and the reduction of costs of entry to places of entertainment, such as the Southbank complex.

5.9 THE GREATER LONDON ENTERPRISE BOARD (GLEB).

The GLEB was created by the GLC in July 1982 as a limited company designed to implement their Industry and Employment policies. It opened for business in January 1983. The GLEB was financed, until the abolition of the GLC, primarily by Section 137 of the 1972 Local Government Act; this refers to the two pence rate to be used for the benefit of Londoners. In addition, the GLEB was free to obtain finance from other agencies in the public and private sector in hand with its investment programme for job creation and job preservation.

The operational guidelines for the GLEB were formulated by the Industry and Employment Committee of the GLC. The main objective was to reverse industrial decline by a strategy of intervention and planning for key aspects of the local economy. The GLEB had a brief to provide technical and financial support to enterprises and make investment interventions that would further the development of London's industrial base, improve technological prospects and thereby preserve employment (Mole and Elliott 1987).

An annual funding agreement reached with the GLEB by the GLC provided a budget of £30 million in 1982/3, £25 million in 1983/4 and estimates for £33 million in 1985/6 (GLEB 1985). Decisions on investment were to be based on both economic and social criteria. The investment functions covered three main areas:

1. Investment to promote strategic or structural change. This refers to investments in industrial co-operatives, new public enterprise and municipal enterprise; areas which were central to the London Industrial Strategy (LIS) and which were unlikely to be supported by existing private sources of funds.

2. General investment covers funding to both public and private sector enterprises within Greater London, however within this category priority is given to enterprises that are newly starting up, at risk of closure or operating in areas of high unemployment, whether this is a geographical area or a particular trade and where retraining opportunities are evident.

3. Development refers to site acquisition, factory building and other related activities (Barratt-Brown 1984a).

The objectives of the GLEB were set out in their Corporate Plan (GLEB 1985). Financial assistance was linked to social objectives; the promotion of enterprise planning and industrial democracy through planning agreements, including the promotion of equal opportunities for women, ethnic minorities and the disabled.

The strategy rested on the creation of a number of functional divisions within the organisation:

Sector Development - where possible, GLEB would assist in the development of London's industries to benefit both consumers and workers. Based on an understanding of the fundamental characteristics of each target sector, the formulation of restructuring plans, and their implementation by specialists through the GLEB's investment strategies.

Equal Opportunities - GLEB aimed to tackle racial and sexual discrimination in all its projects. Enterprises were encouraged to promote equal opportunities and practice for women, ethnic minorities and people with disabilties.

Conditions which linked financial support to the achievement of these objectives was applied.

Novel methods of social ownership and control - this involved the formulation of an Enterprise Plan, the precise form differed according to circumstances. In all cases trade union access was required and an emphasis was put on the improvement of job quality.

New forms of property development - property initiatives were pursued with the involvement of the local comunity, to provide infrastructural support for technology, projects and area initiatives. The GLEB selected two areas as special initiatives; the Hackney Road and the Royal Docks. Area offices were set up, staffed jointly with the GLC, to co-ordinate and integrate the full range of GLEB's programme within the two areas.

Acknowledging the acceleration of technological change, GLEB will continue to play a leading role in the promotion of socially-useful applications of technology, and will actively encourage links between the academic and commercial worlds.

Company restructuring - GLEB will play an exemplary role in restructuring and reviving companies in difficulties by the use of enterprise planning and the application and identification of entrepreneurial skills.

The Co-operative Sector - Co-operatives will be fostered and supported because they represent one radical method of worker involvement in production.

Education and Information - GLEB will publicise its approach to the problems facing the London economy and the role that Londoners can play, using methods which encourage two-way communication with the public (GLEB 1985 p.6)

To ensure the implementation of the strategy the GLEB drew on personnel from a wide variety of backgrounds. The Board of part-time directors had backgrounds from the private, public and voluntary sectors, and knowledge and experience of business, finance, applied technology, local government, co-operatives and the trade union movement. The GLEB houses seven functional divisions:

Sector strategy investigates particular industries of importance to the Greater London economy and develops strategies which guide the GLEB intervention.

Investment Division provides financial and business management appraisal.

Structural Investment concerns itself with enterprise planning, liason with trades unions, and the development of co-operatives, new forms of ownership and control and industrial democracy.

The Area and Property Division tackles the problem of dereliction and high unemployment in parts of London, and is developing an integrated system of property development advice in line with Enterprise Board policies.

The Technology Division sees new product proposals through from initial design to the establishment of manufacturing enterprises, and links academic research to groups in the community with ideas, through a series of technology networks.

A Finance and Administration Division handles the internal organisation of the GLEB, and an Information Division promotes all aspects of the Board's work through press liaison, publications and exhibitions (GLEB 1983 p.7).

For the GLEB the primary emphasis was not a financial return on investment; projects and enterprises supported needed to be viable, however investment appraisal included the assessment of a social return on the community. The willingness of enterprises in receipt of GLEB support to enter into planning agreements, the provision of equal employment opportunities, the manufacture of socially useful products are examples of possible social benefits. This general approach was summarised by the GLEB's former director, Alan McGarvey:

'We do require all our investment projects to be economically viable - otherwise jobs saved or created cannot be secure. But we do not look for the maximum financial return. Instead we look for a social return, in terms of the number of jobs - and equally important, their quality.

Our policy of enterprise planning seeks to guarantee work people basic rights - to trade union organisation, to basic information about their company, to equal opportunities, and to a voice in the future of their companies.

Willingness to implement these policies is a condition of GLEB assistance, just as much as economic viability. Projects which meet these two criteria are also judged by how they contribute to other social objectives. Is the product socially-useful? Is the project of special benefit to women or ethnic minorities? Is the enterprise a co-operative, or one that contributes in some way to greater industrial democracy? If the answer to any of these is 'yes', the project has added weight.

But we also follow strategic objectives for specific key sectors of London's economy, worked out in our sector strategy division in co-operation with the GLC's Economic Policy Group. These strategies don't just provide a framework for judging the projects that apply to us for assistance. They provide a basis for us to go out and actively seek investment openings where we feel this would give us a vehicle for implementing our strategic plans for particular sectors. (GLC 1984a).

The GLEB attempted to achieve these goals by investing in selected areas of high unemployment, and in selected industrial sectors. The approach may best be illustrated by looking at the types of intervention and investment that the GLEB has made.

5.10 GLEB INVESTMENTS.

In its first year of operation the GLEB found itself inundated with requests for assistance. Crisis management, that is, rescues of enterprises facing difficulties or closure comprised a large part of investment activity. The attempt to avoid job loss in larger enterprises was a central concern, it was in this area that 'enterprise planning' and increased industrial democracy were particularly applicable. The following example demonstrates the approach.

The GLC Industrial Development Unit operated an early warning system for firms that were in financial difficulties or under threat of closure. One of the few remaining car component firms in London producing lamps and mirrors came into this category and the GLEB's attention was drawn to it. The trade union convenor, together with the manager made an approach to GLEB. The problem was the attitude of the owners to the business. After lengthy negotiations they agreed to sell. Talks were also held with British Leyland, the firm's main customer. The GLEB bought the company with a £90,000 stake in its future development, thus the employment of 200 workers was secured. The company was not making losses but needed financial investment in the modern equipment and production systems necessary to continue to operate in a highly competitive market.

A new management board was established of GLEB Directors and existing managers. An enterprise plan was negotiated between the GLEB, management and the Unions to include training, industrial relations, equal opportunity provisions, new products, new investments, future wage and price levels and a lasting collective bargaining procedure over these matters. With new ideas from the workforce and with technological back-up from GLEB's New Technology Network, it was intended to help the company to diversify away from its total dependence on the motor car industry (Barratt-Brown 1984b). Worker involvement in enterprise planning and the stress that was put on new product development and manufacturing opportunities had much to do with the influence on the strategy of the Lucas Plan initiative and the development of workers' plans in other industries, together with the 1973 Labour Party Programme on the NEB and planning agreements.

The GLEB also invested in a range of workers' co-operatives, many of them serving 'social markets' or providing community services. The social criteria for investments stand out clearly in this context. For example, Lambeth Toys is a co-operative producing educational toys that reflect the multicultural nature of London. Turnaround is a distribution co-operative specialising in books and pamphlets produced by independent, radical and community publishers that are often ignored by the major distributors; their range covers feminist, peace, gay, ethnic minority, industrial and environmental issues (GLEB 1984b).

Product diversification as a means of regenerating enterprises was a factor in many of the GLEB investments. For example, Walter Howard Design, a furniture company in receipt of GLEB support, and involved in high-volume production of low-priced bedroom and living room furniture had its premises refitted and redesigned in preparation for a new phase of development. The new design-led product range that was planned was aimed at markets in the higher quality furniture sector (GLEB 1984b).

Another example of GLEB support for innovation was Wagon Unloaders Ltd., a Chiswick company which was developing a novel form of freight unloading: the UndeRover. The product was devised in response to British Rail's call for a mobile unloader which could reduce the prohibitive costs of current freight handling which force many smaller companies to transport bulk by road. The GLEB acted to put the company in touch with AMD Engineering, another GLEB investment whose precision skills in engineering were important to the project. A prototype of the UndeRover, a single-person operated, self-powered mobile unloader which could handle solid fuel, grain, minerals, chemical powders and other dry goods, was developed with the help of British Rail Research and the National Materials Handling Centre at Cranfield. The £50,000 investment by the GLEB was matched with a £50,000 grant from the Department of Industry under the Government's Support for Innovation Scheme (GLEB 1984b).

5.11 TECHNOLOGY INITIATIVES.

The GLEB formulated a two-pronged approach to technology, on the one hand a commitment to the design/development of socially-useful products by the creation of a series of Technology Networks. And on the other hand the development of a technological base via property developments; the Technology Parks. This latter side of the strategy was aimed at the 'sunrise industries' of microelectronics, computers and robotics.

The Technology Parks were essentially property developments with housing for small new technology enterprises. They were established around an existing high-technology firm in receipt of GLEB assistance. The cluster of similarly-oriented companies in the electronics sector, for example, could provide a more secure path to the longer-term development of these companies.

The Technology Networks established by the Technology Division of the GLEB were designed to promote technology transfer from academic institutions to local enterprises, and encourage community and workplace involvement in the design/development of socially-useful products. The Technology Networks are the focus of the case-study and are discussed in the next chapter.

In this section the Technology Parks are discussed in more detail. The Synergy Centre was established around AMD Engineering in Richmond, a company involved in the development and production of robotic technologies. The London Production Centre was set up in Wandsworth based on a Rediffusion electronics plant and the Whitechapel Computer Works was established in the West End. These Parks were essentially property developments of the more traditional variety described in Chapter Three. The GLEB bought the premises, provided support in the form of finance and business facilities to existing enterprises and offered nursery unit space for other small start-up enterprises operating in the same technological sector. The expectation was that the Technology Networks would provide back-up technical support, particularly LNTN which was involved in the application of new technologies.

The Technology Parks represent an attempt to intervene in the innovation process in the diffusion and adoption stage, as well as in new product development. The facilitation of the diffusion stage of the innovation process was a key component of the WMEB strategy, particularly in the area of manufacturing technologies, and was also evident in Sheffield City Council's decision to establish a Technology Campus (see Chapter Three).

The general guidelines for investment by the GLEB operated also in the Technology Parks with enterprise planning a central part of the investment package. It was in this respect that the GLEB strategy differed from more traditional approaches discussed earlier.

A brief description of three of these Centres serves to indicate the approach.
The Synergy Centre, known more formally as the Marble Hill Technology Centre was established by the GLEB in April 1984. It was based around AMD Engineering a company rescued from receivership by a GLEB investment of `205,000. AMD Engineering was a company producing high-quality components with a skilled workforce of precision and product engineers. This was the core company on the 28,000 square feet site. The intention was that a number of similar electronics and high-precision engineering enterprises could be housed on the site. Eventually it would become a manufacturing centre for robotics and associated technologies. It was planned that a company founded by John Reekie, described in the New

Scientist as the 'Henry Ford of Robotics', would be established on the site. Reekie pioneered the production of cheap robotics from standardised parts, including robotic teaching aids, and a computer-controlled robot arm. The firm were working on a small-tracked vehicle for bomb disposal, fire fighting and similar uses (GLEB 1984a).

The Synergy Park, according to Dr.M.Cooley, the Director of the Technology Division at the GLEB;

'will ensure a working community of interdependent high technology companies, sharing facilities, striking sparks off each other, and ensuring that their work, and the subcontracting it will produce, all stays in London'.

In particular the high-technology firms would be able to use the skills of AMD craftworkers for their specialised prototype and production engineering requirements (GLEB 1984a).

The tenant enterprises shared wages administration, a canteen, a creche, switchboard, and human centred Computer Aided Design facilities. Tenants were also required to negotiate and implement an enterprise plan with the GLEB. For example, the Enterprise Plan negotiated with AMD Engineering and the relevant trade union (AUEW), included the clause; 'the company will always seek to produce products which are socially-useful. No products will be manufactured which will be used in aggressive acts of war, or are capable of being so used'. In addition there were provisions for worker participation and access to information via consultative procedures and the establishemnt of an elected union worker-director on the company board.

Whitechapel Computer Works was established to support computer hardware manufacturing in London. This start-up enterprise was involved in the manufacture and prototype development of the MGI, a 32-bit workstation with a very high resolution graphics capacity. The American computer journal Byte called it 'the first truly personal workstation', it had particular relevance to CAD applications. The company was based on the GLC owned Whitechapel Technology Centre.

The London Production Centre (LPC) was the outcome of a four and a half million pound investment by the GLEB in a two acre site in Wandsworth. The move by Rediffusion Radio Systems Ltd. to Crawley meant the loss of a hundred jobs for employees unable to make the move. The GLEB scheme meant that these 100 skilled workers could move into smaller companies operating on the site. The specialised companies included Broomhill Electronics, producing circuit boards, wiring harnesses and other equipment. Other companies on the site were involved in activities ranging from plating and spraying, packaging and shipping to printing and maintenance. The remaining space of around 70 per cent of the site was to be converted by the LPC into workshops, office and studio space, with a special emphasis on uses related to the electronics industry (GLEB 1984c).

The LPC represented an attempt to support strategic industries like electrical, electronic and instrument engineering in London. The commitment to 'nurturing' small companies gives a priority to premises. Andy Hartwill employed in the Area and Property Division of the GLEB stated:

'We've already got places to put very small companies when they're just starting out but, at some stage; you have to go into volume production - that's where LPC comes in' (Electrical Review 7.12.84).

The technology networks provided facilities for small batch production in start-up enterprises, it was envisaged that LPC and the companies operating there could provide further manufacturing opportunities for several satellite design and marketing companies with prototype products. This sort of strategy would solve the problem of links with the commercial manufacturing world. This technology transfer strategy was planned for certain products developed through the networks, for example, the microelectronic based energy saving controllers for domestic and industrial heating and ventilation developed through LEEN. In the London Technology Strategy (Blackburn and Sharpe 1987), it was stated that the eventual objective was four to six product design and marketing companies based on the London

Production Centre site clustered around Broomhill electronics as the manufacturer.

The support for the diffusion of new technologies in the Technology Centres by the provision of premises, shared facilities and the possibility of on-site subcontracting work was part of a policy designed to lay the base for the establishment of high-technology manufacturing centres in key industries in London.

5.12 DISCUSSION AND CONCLUSION.

In a review article Benington (1986) lists the main characteristics of the radical local authority initiatives, they;

a. see the public sector as the necessary stimulus for economic change.
b. see lack of planning as a major cause of economic decline, and aim to develop new forms of industrial and sectoral planning, backed up by popular involvement.

c. give priority to the defence and development of existing indigenous industries, technologies and jobs.

d. focus on the sphere of production, as the basis for economic regeneration.

The effective implementation of their strategy would have meant a restructuring of the local economy in the interests of labour. Clearly, this did not happen. The pre-figurative or exemplary nature of the policy initiatives coupled with the power of rhetoric and politics makes any assessment a difficult undertaking. Sharples (1986) notes that this is because; 'much of the local economics is hypothetical, an account of what could be done with more resources, powers and time for local authorities'. That said, it does not preclude a closer investigation of some of the problems faced by the GLC and the GLEB with policy implementation.

As mentioned in 5.1 the emphasis on the sphere of production was strongly influenced by the political economy of the C.S.E.. Robin Murray (1985), the Chief Economic Adviser to the GLC wrote;

'We see industrial policy as being primary, conducted not through the general manipulation of markets, but by particular interventions in production, enterprise by enterprise, branch by branch,' (he added) 'as long as the market and profitability remain the main economic mechanisms there will be an inherent tension'. (Further) 'in intervening in the market economy, what we aim to do is strengthen the socially-useful forces, however bound they may finally be by the conditions of profitability. That is why we speak of operating in and against the market'.

This economic analysis is particularly suited to local authority economic intervention, a point supported by Sharples (1986) when he notes that it plays down the importance of macro-economics and demand management, both outside the control of the local authority. For the GLC/GLEB the problems of the local economy lay in production rather than a lack of market demand, the focus of their attention was particularly on the manufacturing sector. For Murray (1985) progressive planning and sectorially targeted industrial investment was the route to economic regeneration. Nevertheless, the problems for local authority economic activity that were mentioned in Chapter Three were evident if some of the GLEB's activities are looked at more closely. Not the least was the tension inherent in the policy between social-use and profitability, between challenging or accommodating the realities of productivity and market competitiveness. This was the same tension that emerged with the Labour Party Programme of 1973 and articulated as: should the criteria for economic intervention support or supplant market forces (see 5.3).

The legislative and financial constraints affecting local authorities means that economic intervention will necessarily have a marginal impact on the local economy. In many cases the ownership and control of companies lies outside the local area (Cochrane 1983). The lack of statutory powers of intervention meant that the GLEB were dependent on companies approaching them for assistance, this was the only way that they could obtain any leverage over company activities. Thus, the GLEB faced the same problems that bedevilled the NEB established by the Labour Party in 1975. In its earlier stages it led to an emphasis on rescues of enterprises facing difficulties, in its later stages when sectoral strategies were more developed, it severely curtailed effective implementation.

The companies that approached the GLEB were usually facing cash-flow problems, imminent closure or difficulties relating to maintaining competitiveness with outdated equipment. Support for product diversification was seen as central to the economic regeneration of failing enterprises, or enterprises which needed to increase their competitiveness in a particular market. The GLEB provided risk capital to start-up and larger existing enterprises for commercially-oriented product development which, though problematic offered the possibility of some commercial success and job preservation. However, in its early stages of operation the GLEB found that enterprises in need of support did not require much technological aid, rather it was more a question of the retention or expansion of existing markets and production activities in selected sectors.

In an interview (Interview-Johnson 1986) with an employee at the Technology Division of the GLEB in 1986 the difficulties experienced by the GLEB were described. He argued that criticism of the GLEB tended to focus on its structural and managerial nature. In fact, to understand the failure of some of their portfolio investments it is necessary to look at the economy and the problems in particular industrial sectors of markets and terms of trade. The main question should have been are projects able to continue on that basis, rather than can jobs be saved. According to the interviewee, in view of the problems faced by the economy most investments made by the GLEB were mistimed and inadequate in terms of finance. One example is that of a foundry in Croyden. Their market was almost entirely composed of one customer, a company producing washing machines. The targets that the foundry needed to reach to become economically viable were all over-estimated, plans were afoot to expand even though they were unable to maintain supplies to existing customers. For the foundry, terms of trade worsened, their equipment was outdated and they could not deliver the quality. Within this industrial sector the name of the game is quick turnaround and high quality. The firm drifted along for a while and eventually collapsed. Newman (1986) notes that the bankrupcy of William Howard Designs following an investment of £500,000 was a spectacular example of the problems involved in putting new investment into enterprises with capital shortages and management and market problems.

With many of their interventions the GLEB faced the constraint of poor quality management. John Palmer, the former Director of the Information Division at the GLEB articulated the problem;

There was a 'quite appalling dearth of quality professional management to be found, particularly in small to medium-sized businesses. All too many firms who find

themselves seeking help from local enterprise boards or other agencies are in that position because of the low grade quality of their management as much as any other factor.
Even when enterprise boards start off with a determination to maintain a hands' distance' relationship with their investments they often find themselves being drawn into direct management' (Guardian 24.12.85).

This posed problems for the GLEB who did not have marketing and entrepreneurial expertise, largely as a consequence of the difficulties of recruiting personnel with the correct mixture of skills. Newman (1986) summed up the problem when she wrote;

' There are few committed to the GLEB approach who have a financial or industrial background together with experience of industrial democracy, the GLEB underestimated the importance of the new type of management skills required'.

The GLEB encouraged in-house product diversification in enterprises it supported, it also encouraged new product development through the Technology Networks. Where product development was supported it was found that although products had been developed to marketable product stage, industrial partners and private investors were not easy to find for the stage of moving to full-scale production. This was the case with two of the products developed in the London Energy and Employment Network's workshops. John Palmer, the former Director of the Information Division at the GLEB saw this as one of the difficulties faced by enterprise boards:

'There have been cases where local enterprise boards have facilitated the development of innovative and potentially world-beating new products only to find that it is next to impossible to secure commercial exploitation (Guardian 24.12.85).

Whilst the GLEB were able to provide 'seed-corn' finance to inventors to support projects at the development stage they did not have the resources to invest in full-scale manufacture and production. The original idea was that such products would prove attractive to commercial interests. Once developed to manufacturable stage, the product would be taken up by the conventional market mechanism with possibly the original company itself being taken over by a larger one. There are several reasons why small firms manufacturing single products are not very viable commercial projects; the costs of manufacture of an untried and tested product, the finance for new product development or products are considered too novel (Mole and Elliott 1987). To some extent this problem was addressed in the Technology Centres. The manufacture of high-technology components in the core company on the site solved the problem of access to manufacturing opportunities and moving from product development into volume production for smaller start-up enterprises. The aim was to link the innovative power of the Networks (discussed in Chapter Six) to a federated cluster of development, production and marketing companies with adequate manufacturing capacity.

The GLEB strategy stressed the sphere of production rather than distribution or marketing. For interventions the social objectives of job creation and preservation necessitated the economic viability of the company. Thus with rescues the GLEB were forced to operate within the market. Enterprise planning was the means by which the wider social objectives could be achieved. However this raised the other problem that emerged from the Labour Party Programme in the 1970s; how were implementation and monitoring to be achieved? Cochrane (1983) noted the difficulties of monitoring planning agreements for enterprise boards. Enterprise planning was dependent on strong workforce representation via trade unions for implementation. In this way top-down provisions by the GLEB could be met with shop-floor planning from below. This part of the initiative built on the experience of workers' plans during the 1970s. However, the Lucas Plan represented part of a campaign against redundancies, it was not an on-going political project in the company. Enterprise planning has never been part of the trade union culture, in the 1970s their response to the Bullock Report indicated their belief that it was incompatible with collective bargaining procedures (see 5.3). Thus even in enterprises with a strong trade union organisation this part of the economic initiative would face problems. In addition, many of the companies that approached the GLEB were medium to small in size and had only a weak trade union organisation, so that it proved difficult for workers to participate effectively. To achieve effective implementation the policy would require the GLEB to take an active role in the day-to-day management of the company. In an article on the GLEB, Ines Newman (1986) an employee of the London Borough of Hackney Economic Development Unit, raised the problem of monitoring in relation to equal opportunities, particularly in skilled manual areas of employment which are traditional male preserves. The strategy faced the problem of fostering social investments or furthering social objectives that in many places hardly exist in the real world; for example, equal opportunities for women in male-dominated areas of employment, black enterprises and enterprises run by women.

This brief run-down of some of the problems facing an economic strategy of this kind illustrates the difficulties for an organisation like the GLEB of operating within a capitalist system in the throes of economic recession. Coupled with the external constraints on policy implementation were co-ordination difficulties between the GLC and the GLEB. Different groups within the organisations pulled in different directions, some emphasised new products, some sector strategies and some property developments (Mole and Elliott 1987). The background and particular concerns of key individuals had an enormous impact on policy formulation and implementation. Mike Cooley, the Director of the Technology Division at the GLEB 'product championed' the Technology Networks. Their brief closely followed the experiences of alternative product development emphasised in the Lucas Plan. Popular planning was very much the central concern for Hilary Wainwright; the Director of this Unit at the GLC. Her background in the womens movement and workers' planning served to emphasise the pre-figurative nature of the GLC approach. Whilst the different political orientations of groups and individuals does not preclude their working together on a co-ordinated economic policy, it did mean that the strengths of personalities was a relevant, and sometimes oppositional, factor in the achievement of a co-ordinated policy.

Throughout the period of office for the Labour GLC policy initiatives received high media profile. This pressure forced the need for 'successes' to exemplify the 'value for money' of a politically interventionist approach. Again this acted to force the initiative toward a rescue-type approach where 'jobs saved' could be headline news. The job creation and preservation brief for the GLEB presented dilemmas in the form of where to aim priority investment. Should the GLEB support new small businesses in high-technology areas, such as in the Technology Parks, or concentrate on saving existing jobs and funding labour intensive co-ops making socially-useful products. The constraint on public spending meant that the possibility of influencing public sector demand for socially-useful products was minimal. Products may be socially-needed but it was difficult to create a specific economic demand for them. An urgent requirement was for ways of creating markets, for example, buy locally, brand image (GLC product), mechanisms for linking producers with consumers.

The Labour Group's original manifesto commented that 'although national measures will also be necessary, there is much that a regional authority like the GLC could do' (Barratt-Brown 1984a). Barratt-Brown, a member of the Economic Policy Group at the GLC, went on to argue that the GLC's overall programme of investing in jobs and restructuring the London's economy;

'was, in effect, rendered impossible by the absence of any positive national measures, indeed by the privatisation of the public sector and by the capping of Local Government rates and ultimately the abolition of the GLC.'

He suggested that ultimately much of the GLC's industry and employment work was inevitably therefore defensive - trying to resist cuts.

The effect of these legislative pressures on the GLC/GLEB was explained by an employee at the Technology Division of the GLEB (Interview-Johnson 1986). With the planned abolition of the GLC in April 1986, restrictions on funding were introduced by central government in 1985 (see Chapter Three). The GLEB's own funding was curtailed at the beginning of 1985 which led to restrictions on new investments, and difficulties of funding existing portfolio investments that required relatively large amounts. From mid-1985 the GLEB Board were not keen to commit new money.

The Conservative Environment Secretary, Kenneth Baker, argued for an increased accountability for the GLEB once the GLC was abolished.. During the plans for the changeover of funding from the GLC to the London Boroughs, funding for the GLEB of eight million was tied up by the Conservative Government, thus they were unable to continue many projects. With the impending collapse of key projects, a project team approach was developed in GLEB to support these enterprises. However, as one commentator working in the GLEB at that time noted, these teams were literally made up of people who were willing to get involved but did not have the relevant expertise.

Funding continued to be a problem and in early 1986 the GLEB was re-organised and slimmed down from a staff of 90 to 66. Splits began to emerge in the organisation between employees with a commitment to the principles of the GLEB, and other whom the commentator termed 'careerists'.

At the time of writing the GLEB still exists, although it has slimmed again to thirty five people. The funding it receives is from small subscriptions from the London Boroughs, and the sale of viable projects and property. The funding largely goes towards wages. Spending on investment requires residual monies to achieve a going concern status. This has had a drastic effect on viable projects, for example, AMD Engineering faced cash-flow problems that would have been alleviated by the end of the year, but the GLEB were unable to provide investment.

This discussion of the problems facing policy implementation for the GLEB has made the strategy sound like a rather ad hoc entrepreneurial initiative. It was an economically and politically ambitious project, bound by its very context to run into difficulties. As Ken Livingstone, leader of the GLC wrote;

'The Labour Party has seized on the important but limited success of Labour council Enterprise Boards as the answer to our problems at exactly the same time we have realised the limits of their effectiveness' (Guardian 23.9.85).

The radical economic strategy based on production for social need was difficult to put into practice in existing enterprises. In the next chapter the Technology Networks are looked at in detail. Their potential role in a policy based on planned production for social need centred around the design/development of socially-useful products and the close connection between producers and users. Benington (1986) summarises this approach to an economic strategy. The local authority is in a good position to recognise unmet needs, often their collective provision is included in their statutory duties, for example, the heating needs of council tenants, aids for disabled and so on. The Technology Networks were designed to act as a bridge between users with unmet needs and unused technical capacity. In some cases the local authority (eg. the development in Sheffield of a dehumidifier to tackle the problems of dampness and condensation in older housing) has been able to provide both the finance and skill to develop the product, and the purchasing power to provide a stable market. The role of the Technology Networks in this form of economic strategy is discussed in Chapters Six and Seven.

CHAPTER SIX: THE TECHNOLOGY NETWORKS.

6.1 INTRODUCTION.

Local authorities have developed their role in economic development largely as a response to growing unemployment and local industrial decline. With only limited financial resources many policy initiatives have been only indirectly concerned with the creation of employment (see Chapter Three). The GLC/GLEB explicitly identified technological innovation in the form of socially-useful products as one means to create employment. They were concerned to influence the political allocation of resources to technology and thereby achieve some leverage over the form and direction of product development. But equally importantly, they were concerned to influence the nature of the technology itself by creating the facilities to encourage an alternative social organisation of the product design/development process in the form of the Technology Networks.

The GLC/GLEB approach to technology was strategic, in the sense that its response to technological opportunities was to provide 'seed-corn' finance to projects at an early stage of development. This point in project/product development is an area where difficulties maybe encountered in gaining access to funding from the more traditional sources, such as, banks, venture capital agencies and so on.

The Technology Networks and Technology Parks represented the main elements of the GLC/GLEB Technology Strategy. In both areas the aim was to 'nurture' the design/development of new products. The Technology Networks were designed to give back-up support and facilities to user groups, and, in addition, to facilitate technology transfer from academic institutions to local enterprises. The Technology Networks comprise the focus of the empirical research. The Technology Parks, described in the previous chapter, were designed to provide a secure environment for start-up enterprises.

The general economic and social criteria for investment in companies formulated by the GLEB applied also to technological projects. Priority was given to projects which had technological implications for the local community and the local boroughs. Particular emphasis was given to socially -useful products and exemplary projects which extended technological opportunities to otherwise disadvantaged groups, for example, training in new technology for women and ethnic minorities.

The technological areas that were delineated as appropriate for the GLEB Technology Division support were areas which did not have huge entry costs, were not capital intensive and did not use technology to downgrade or destroy skills and knowledge. In relation to the Technology Networks, the GLEB's role in technology policy was to create the facilities for the development and promotion of socially-useful products and technology transfer through the Technology Networks to local enterprises.

This chapter describes the background, role and operations of the Technology Networks and comprises information gained through interviews with respondents who were directly involved in the technology policy implementation process. First the background to the idea of the Technology Networks is described and then a short case-study of each Network is presented. Findings are collated under the general headings of a) background, b) policy, c) day-to-day operations, d) user involvement, e) access to technical resources and f) socially-useful products.

6.2 BACKGROUND TO THE TECHNOLOGY NETWORKS.

The Labour manifesto for the 1981 local government of the 'radical' Labour-controlled GLC put a special emphasis on 'production for need', referring specifically to the Lucas Aerospace workers' campaign for the right to work on socially-useful products (discussed in Chapter Two). The Manifesto read:

> Groups of workers such as the Lucas Aerospace Shop Stewards' Committee have, with the support of the Labour Party, begun to develop ideas on alternative production - using technologies which interact with human skills; making goods which are conducive to human health and welfare; working in ways which conserve, rather than waste resources.
> We believe that these initiatives - which constitute a fundamental rejection of the values inherent in capitalist production - must be supported by a Labour GLC. We shall therefore be prepared to assist groups of workers seeking to develop alternative forms of production, with finance, with premises, or in other ways (Labour Party 1981).

The Technology Division of the GLEB was responsible for the implementation of the technology strategy. The Director of the Division was Mike Cooley, who had been a leading figure in the formulation of the Lucas Plan. He joined the GLC in 1982 as one of the first members of the Economic Policy Group, and he moved to head the Technology Division when GLEB became operational in 1983. The Technology Networks were based on two organisations that had been created to work on product proposals presented in the Lucas Plan: the Centre for Alternative Industrial and Technological Systems (CAITS) in London and the Unit for the Development of Alternative Products (UDAP) in Coventry. These organisations sought to develop product prototypes on the basis that the more prototypes of alternative products designed and developed to meet the social needs of both the producer and the user, the stronger the bargaining position of workers fighting redundancies.

CAITS was founded in 1978 at North East London Polytechnic by Richard Fletcher, a lecturer in the Engineering Department and Mike Cooley. Activities at CAITS encompassed practical work on product prototypes and the political promotion of the concept of socially-useful production. Although a balance was sought between practical and political activities, CAITS became rather more well-known on the political side as a centre of expertise on workers' plans and socially-useful production.

UDAP was established in 1981 with funding from the Cadbury Trust. It is located in the Engineering Department of Lanchester Polytechnic and mainly emphasises the practical activities of work on product prototypes through student engineering projects.

The Technology Network proposals included both political and practical activities for the promotion of socially-useful production. Although they were not to be located within academic institutions, the links with these institutions was seen as a means to foster a pool of academic theoretical design and technical skills that could be matched with the 'tacit' knowledge; 'the things we know but cannot tell' (Polanyi 1976 p.79) of workplace and community groups. The creation of facilities in the form of the Networks would allow both forms of skill to be acknowledged, exercised and developed. The Networks were designed to facilitate the production of alternative products on a local or regional basis rather than only within companies, like Lucas Industries which employed a high proportion of design and technical staff (Wainwright and Elliott 1982).

The Industry and Employment Committee of the GLC in its 1982/3 Capital Programme for GLEB included a provision for expenditure of up to £3.2 million on technology. It was proposed that the Council's concern to develop new technology would be most effectively implemented by the establishment through the GLEB of a number of area-based and product-based Technology Networks incorporating innovation centres, product banks, machinery/production/equipment banks and technical support and advice units (GLC 1982).

In their General Policy Document (GLC 1982) the GLC acknowledged the need to look at the problem of technical change in many of the industrial sectors in London and to attempt to harness the appropriate use of new technology to the creation of employment. The support for new technologies was based on the view that 'human-centred' technology, which builds on human skill rather than displaces it, was the preferred direction of technological advance. It was stated that 'new technology can be designed to maintain and develop existing manual skills and tacit knowledge in a way that enhances work rather than degrades it'(GLC 1982 p.1)

Thus, whilst the GLC and GLEB recognised the importance of technology to the development of the London economy, the emphasis was put on 'alternative ways in which (it) can be introduced, which have quite different implications for energy and material use, for ecology, for those who operate the new technology and for those who use or consume its product' (GLC 1982 p.2).

Two central propositions informed the GLC approach to technology: first, that 'one of London's most precious assets is the skill, the ingenuity, the creativity and the sheer enthusiasm of its people'; and second, 'London possesses in its three Universities and seven Polytechnics one of the richest scientific resources in the world' (GLC 1982 p.2).

Against this background of thought on technological alternatives, and influenced by the nature and role of CAITS and UDAP the creation of five Technology Networks was proposed. The Networks were to exhibit the following features:

a) they would be based in separate buildings or in a distinct area of an existing Polytechnic or University College, and be staffed by people who act as the interface between the professional scientists and the community. They would be sited and designed in order to welcome those who would normally be hesitant to enter academic institutions, perhaps having a shop-front as the Science Shops have so successfully done in the Netherlands.

b) they would include a new enterprise support unit which could provide technical, production, planning and marketing advice to co-operative production and other similar initiatives, drawing on the expertise within the scientific institution, as well as the skill of their own small staff.

c) the small interface unit would arrange for appropriate contact for people in the community to make use of the facilities of the polytechnics and universities for their own research and development needs.

d) the centres would be intentionally sited in localities rather than being concentrated at one place in London in order to widen the access of people to them. At the same time they would be able to draw on GLEB's central technological resources for specialist help.

e) the networks would also encourage undergraduate and post-graduate projects on product ranges that would be useful to the communities around them.

f) we would expect some specialisms to develop between the networks, determined in part by the facilities and special expertise of the institutions to which they were linked (energy on the South Bank, for example), and in part on the needs of the area (ie, the need for mechanical and engineering technology in the West London area).

g) each network would contribute to a product bank which would consist of a pool of product innovations which would be patented for use by working people. An Innovation Bank of a similar sort has been developed in Limerick in Ireland, sourced both by product ideas produced in Ireland as well as those imported from abroad. The British Technology Group (BTG) also have available product proposals which may be licensed by enterprises. In the case of the technology networks, we would expect ideas to be contributed from the educational institutions, from technical and manual workers in the workplace and communities, as well as being brought in from abroad.

h) the networks would also include as appropriate a machine bank, consisting of second-hand machinery which had been refurbished as part of a training programme and was then available for use by co-operatives and other appropriate groups.

i) the networks should aim to involve in their management and day to day operations not only representatives of the scientific community, and of locally-based workplace groups, but also representatives of the local community and other voluntary groups concerned with the development of socially-useful technology (GLC 1982 p.3)

The Industry and Employment Committee (IEC) Report on Technology Networks has been described in full because it provides a good account of the basic idea of a technology network - in theory. The creation of organisations to promote the appropriate use of technology to satisfy needs that are unmet by the market offers an example of an approach to technology transfer, product development and design which is democratically controllable and open to the influence of trade union and community groups.

The central objectives of the Networks; user involvement in product design/development and the establishment of direct links between innovation and employment meant that in practice the networks differed quite substantially from the CAITS model. CAITS had clearly defined and focused activities in both a political and practical sense; it provided information and technical assistance to workers developing alternative plans in particular industrial sectors. The Networks were more loosely defined and faced the task of building their own political constituencies.

Five Technology Networks were established, two were area-based and three were technology or issue based. The area-based networks were Thames Technet, the South-East network which was linked to Thames Polytechnic, and the

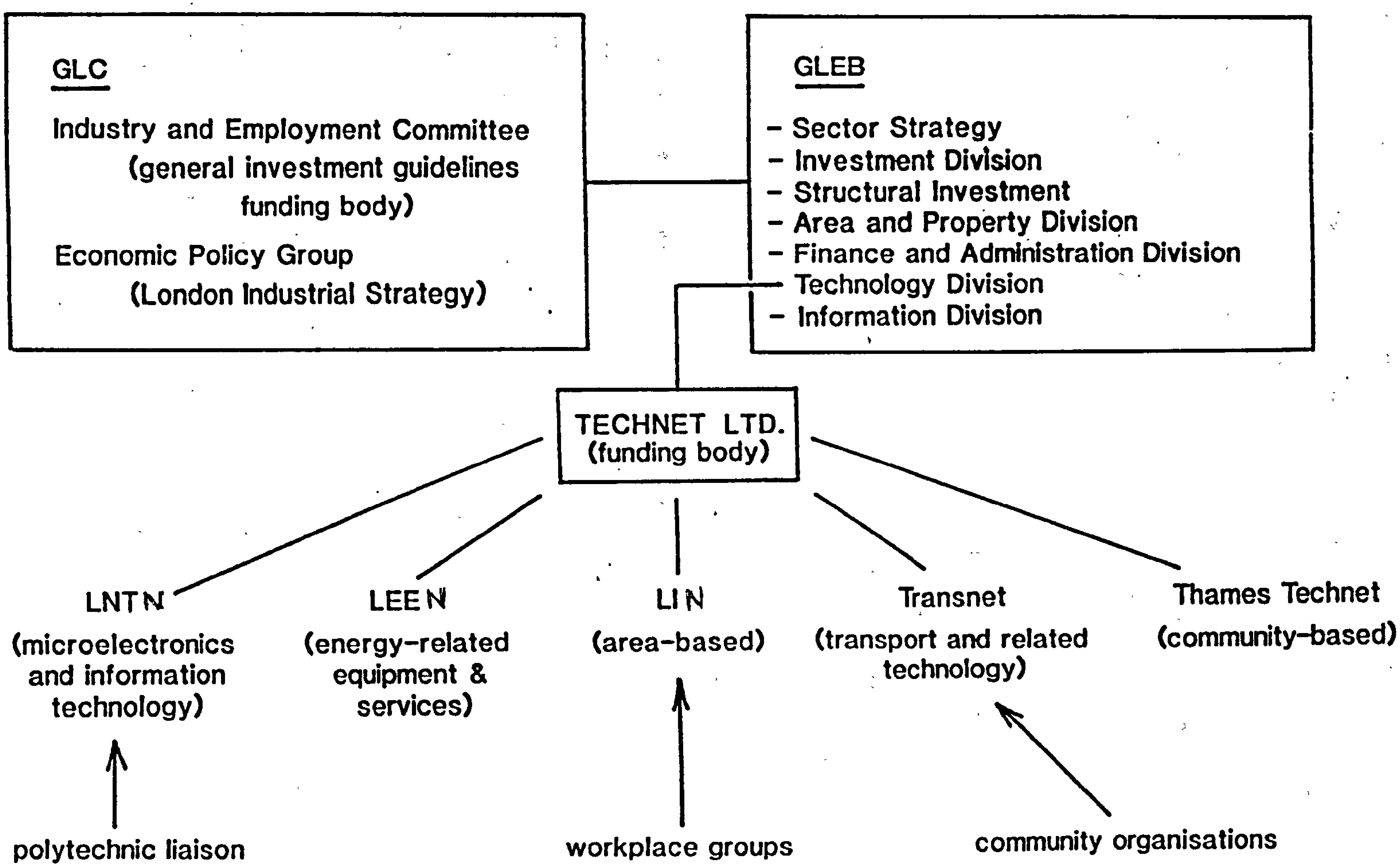
Product and Employment Development Network for North and East London (PEDNEL). This latter network was then changed to the London Innovation Network (LIN); and had links with the Polytechnic of North London and the Design Development Unit (DDU) at Middlesex Polytechnic. The three technology/issue based networks were the London Energy and Employment Network (LEEN) which focused on energy related equipment and services, the London New Technology Network (LNTN) which focused on microelectronics and information technology and Transnet which focused on transport issues and related technologies. (SEE FIGURE 4.)

The five networks had both trade union and community group representatives together with representatives from voluntary sector groups and the polytechnics on their management committees. They operated as independent organisations with their own buildings, administrative staff and workshop facilities. The funding of projects was via Technet Ltd., a company formed by the Technology Division at the GLEB. The Management Committee, known as the Network Council was responsible for policy decision-making within the general guidelines formulated by the GLEB, administrative staff were responsible for day-to-day management.

It was envisaged that the Technology Networks would provide the research and development facilities, using the polytechnic resources if necessary, for the development of

FIGURE 4.

Organisation of Technology Networks



prototype products which could feed into the GLEB's wider strategy of support for new and existing enterprises. The product prototypes would then be produced and manufactured by GLEB supported enterprises and co-operatives.

The technology networks represented elements in an essentially supply-side strategy (technology-push) to be met by the 'market' of unmet needs (demand) articulated by the community and workplace groups involved in a process of local planning and enterprise planning. The 'market' was seen to comprise of public sector service provision or the social market.

The major concern for the networks in their early stages was the formation of an organisation and focus that could begin to address the problem of how to promote socially-useful technologies within the dominant culture of a competitive market economy.

The wide brief of the Technology Networks meant that the forms of organisation and operations; the practical implementation of the brief, depended, to a large extent on the perceptions and interpretations of key individuals directly involved in the policy process. As the Networks are described the differences between them and the strategies employed to achieve policy objectives are apparent.

6.3 THE LONDON ENERGY AND EMPLOYMENT NETWORK (LEEN).

LEEN was the first network to be established. It was formed in 1983 and began life in County Hall, later moving to offices in Avonmouth Street beside the Greater London Enterprise Board (GLEB). The building, called the London Energy Centre, housed substantial workshop facilities for product development. The LEEN finally settled in refurbished premises near Kings Cross. These moves reflect phases in the development of the network.

a) Background.

LEEN began as an umbrella organisation for a number of groups interested in energy-related issues, these included the London Network for Alternative Technology and Technology Assessment (NATTA), the Intermediate Technology Development Group (ITDG), the Socialist Environment Resources Association (SERA), the Energy Resource Research (ERR) group and representatives from the South Bank Polytechnic's Centre for Energy Studies. In addition, the Central London Polytechnic was involved via its support work for the establishment of an Energy Conservation and Solar Centre (ECSC) which gradually took a leading role in LEEN. Local Heating Action Groups, the Warmth Energy Saving Co-operative and the Lewisham Energy Centre became involved at a later stage. The initial formation of the Network as a loose federation of interested groups meant that the development of the Network could be divided into two distinct phases. This presented a choice of respondents to contact for the arrangement of interviews. The decision was made to interview two people, from different groups involved in the project during its initial phase; Adrian Atkinson from SERA and Colin Hines from ERR, and to interview the Development Manager of LEEN after its re-organisation; Susie Parsons.

At the outset LEEN had an open form of management and functioned as a funding body for different organisations involved in particular energy projects. The main focal structures were the London Energy Centre at Avonmouth Street and the ESCS at St. Pancras.

The energy and employment brief was very broad and posed difficulties for the initial activities of the definition and establishment of a coherent organisation. The idea of a network was as a federation of groups that came together to work on a particular project; this definition raised the problem of organisational structure (Interview-Atkinson 1984).

The model for innovation that formed the basis of the Network idea was potential user involvement in product development. At the initial stage this meant that there were a spectrum of ideas on the best model of a network among the groups involved, ranging between technology or products and energy conservation as a service. For many of the alternative energy organisations their interest was in utopian change rather than technology thus the product concept was unclear and irrelevant (Interview-Hines 1984). Those groups who were more technically oriented had little experience in the design and innovation of products. For Adrian Atkinson (Interview 1984), the technology focus was seen as a central element to the network but should exist alongside the opportunity for grassroots initiatives in the form of popular planning for employment around energy problems. For groups like the Warmth Energy Co-operative and the Lewisham Energy Centre the focal point was on low-technology energy conservation measures for their main constituencies of community groups. For many of these groups the relevance of some distant network was questionned. At this stage LEEN operated as a funding body in receipt of a flood of proposals from groups involved in energy issues. The LEEN Council was made up of nine members of energy organisations and three appointees from the GLEB. The Council vetted proposals and attempted to establish priorities and a policy framework. Susie Parsons, the Development Manager of LEEN after its re-organisation described this period as one where 'people already involved in energy issues handed out money to each other' (Interview-Parsons 1985), a view also upheld by Colin Hines the respondent from ERR.

In the first year of its life LEEN did not have a central strategy or written plan. The models of the network preferred differed widely, for some an entrpreneurial model was favoured, whilst others argued for a small organisation designed to encourage local initiatives and give local authority funding some kind of voice. The projects reflected this diversity. ITDG was involved in small business packages, London NATTA in energy conservation in local authority and commercial buildings, the ECSC in district heating schemes and draughtproofing co-operatives. Atkinson (Interview 1984) referred to LEEN at this point as 'an umbrella for different opinions and peculiar alliances'. It was his belief that the atmosphere in the Network was one of 'you scratch my back and I'll scratch yours', the different organisations involved had a variety of priorities and axes to grind, there were vested interests and too many disparate projects, although the main emphasis was on energy-saving measures.

b) Policy.

Following this period it was decided by the GLEB that a more corporate structure was required, with full-time employees, if LEEN were to develop a co-ordinated policy and strategy.

The network then moved away from a loosely co-ordinated open structure to a solid organisation with a strong central core. From July 1984 this re-organisation meant that LEEN employed its own staff and had a work programme that was in part to do with job creation and energy projects and partly organised as a consultancy. The Development Manager appointed was Susie Parsons who immediately began work on a strategic development plan. Given the explicit employment brief there was a need to identify the best strategy for a potential impact on employment, the network did not have the resources for more direct job creation. Priority was given to the promotion of employment through energy efficiency measures and services; an area that had been identified in the first draft of the London Industrial Strategy. In the field of energy, at least at the local level, the main factor was not the lack of socially-useful technologies; what was required was the political, institutional and financial commitment of resources that would allow for the implementation of these technologies (Interview-Parsons 1985).

The LEEN policy was to direct attention to energy issues on three levels. Working with a number of local authorities, trade unions and voluntary organisations 'The Charter for Energy Efficiency' developed by LEEN was aimed at influencing energy policy at a national level with guidelines and recommendations for policy initiatives on energy efficiency. In London, the London Energy Action Plan was launched in April 1986, this was a London-wide policy for energy efficiency that included estimates for investment resources and potential pay back. At a local level the LEEN worked with some London Boroughs in the provision of practical advice and services. This involved training on energy awareness for local authority employees, tenants groups, advice agencies and so on. Training courses on draughtproofing programmes were also developed. The aim was to identify energy problems that tenants had in order to give the apppropriate advice, and raise conciousness about energy issues. For local businesses the LEEN were concerned to develop advice services on organisation for energy efficiency, access to finance and so on.

c) Day-to-day operations.

LEEN was organised as a company limited by guarantee, it had a membership of fifty organisations in 1985. This had risen to seventy by 1987 and included tenants associations, community groups, local authorities and trade union organisations (Parsons 1987). The management or Council was comprised of Technet appointees, elected members from the organisations and co-opted members who represented particular interests that were relevant to the work of the network. Twelve full-time staff were employed, this included eight consultants from the member organisations and five administrators. The staff were largely composed of people with technical qualifications and experience and included a spread of engineers, architects and those with energy study qualifications.

In its first year of operations LEEN was funded by Technet Ltd. Budget requirements for the year were around £430,000 pounds. By the second year LEEN had begun to generate a small amount of revenue with the aim of producing a third of its own income. At a later stage it was estimated that it would need to produce half of its own income if it was to keep going. In the year 1986/7 42% of funding was from the sale of services and products and commissions for specific services (Parsons 1987). In addition the LEEN produced publications on 'Energy in the Eighties' as a means of generating income. Publicity was important for the task of establishing the network as the centre of expertise on energy issues in London, they produced a quarterly bulletin and were concerned to gain a fair amount of press coverage through frequent press releases.

The main focus for LEEN was to work with local authorities on their energy policies; Right to Warmth policies were introduced in the London Boroughs of Hackney and Islington. LEEN provided the back-up support in the shape of heating advice services to tenants, housing associations and the local authority. These heating and insulation packages consisted of a combination of different conservation measures appropriate to particular types of housing stock, for example, tower blocks in Hackney and old people's homes in Southwark. To support this work LEEN funded ERR to develop a computer programme; Heatplanner as a tool for agencies concerned to measure the costs/benefits of energy efficiency measures. LEEN also funded ECSC to develop a new type of low-cost data logger for use in energy audits in public buildings. The exemplary use of these measures in Council housing in Hackney provided a model of requirements for London's housing stock. The use of this model added potency to local authority campaigns for finance from central government to invest in energy efficiency and conservation measures for council housing.

d) User involvement.

Participation and user involvement in the network was through membership of associated organisations, the LEEN compiled a mailing list which had grown to eight hundred in 1985. Although the network was accessible, the LEEN did not pursue a shop-front policy. Susie Parsons (Interview 1985) noted that 'people do not travel for information, it was a better strategy to compile information on specific areas that were applicable to certain groups of tenants and then go to them to advise on their heating problems'. LEEN was concerned to build alliances with community groups and local councils to provide user feedback on heating and energy efficiency needs. This was achieved by a deliberate strategy of seeking to recruit community organisations and trade union branches into their membership. Thus their strategy for participation by users tended to be pro-active and centred around specific issues and specific localities, such as a local authority housing estate.

e) Access to technical resources.

The establishment of links with the Polytechnics; South Bank Polytechnic, Central London Polytechnic and Imperial College were not easy. Parsons (Interview 1985) argued that there was a flaw in the theory that people in academic institutions were interested and had goodwill towards projects; she added, 'this was a misconceived notion, links with the Polytechnics were very dependent on contacts, personalities, and individual commitment'. The current nature of funding in academic institutions centres on the concern to gain research contracts, thus individuals were reluctant to give unpaid time. The links with other networks were achieved through meetings and collaboration on specific projects, for example with Thames Technet on advice for an energy-saving community laundry, and with the London

Innovation Network on a low-energy house. Links with the Technet Ltd. at the GLEB were good, again this was dependent on personalities but Parsons felt that their contact person in Technet was supportive and ready to give sensible advice (Interview 1985).

f) Socially-useful products.

Product development was in the workshop facilities in Avonmouth Street and consisted of a rolling programme. Most of the projects were initiated by people already involved in LEEN or individualsconcerned to develop their existing capability or ideas. LEEN were concerned with commercially viable products and had the facilities for small-batch production if a market assessment had been encouraging. For example, an inventor from Reading University contacted LEEN and ITDG with an idea for a small and economic 100W wind turbine. The product had a potential market as a domestic electricity source, and was also useful for developing countries, for example there was some interest expressed from Vietnam. Once the development work at the LEEN workshops was completed an independent company was established.

Another example of product development was the 'Pedelec Stella', an electric bicycle developed by a sole inventor who was then able to gain development facilities in the LEEN workshops and financial assistance of £76,000 for development work from the GLEB. The bicycle was launched in March 1985, just after the launch of the Sinclair C5 Electric Tricycle, and a production company was established for the product.

Other projects supported by the GLEB and the LEEN included a novel steam engine for a motor launch developed via ITDG, and a domestic heat pump system developed by LEEN. Two prototypes of the domestic heat pump were developed and tested in 1984 and ten units were scheduled for production in 1985 for field testing. LEEN also developed a user friendly heating controller, and a ventilation control unit. The LEEN workshop facilities were used for further development on the road/rail bus prototype which was initally built at CAITS/NELP using a conventional bus that was modified to be able to run on both road and rail. This was one of the projects that had emerged from the Lucas Plan.

It was hoped that the products and projects that were developed in the workshop at LEEN with investment finance from the GLEB would, with a working prototype, be more likely to attract finance for production and manufacturing from agencies involved in the distribution and investment of capital - banks, venture capital agencies and so on. In this way the GLEB and LEEN's role was of nurturing embryonic projects with socally-useful and employment potential by supplying the initial investment research and development facilities. By 1987 LEEN had had one product, a single board computer, on the market and was negotiating with a potential manufacturer for the datalogger for environmental monitoring (Parsons 1987).

LEEN was not only-concerned with new products, an increasing emphasis was on the deployment and use of existing, fairly simple energy saving measures such as draughtproofing, backed up by advice, information and monitoring services.

For the LEEN the main strategy was to campaign for resources for existing technology to be used. They did not see themselves as a job creation agency, they did not have the investment capacity. Nor were they a business that could be assessed by economic criteria. However, their potential for indirect job creation was very large. And of course jobs were created in the organisation itself.

6.4 THE LONDON NEW TECHNOLOGY NETWORK (LNTN).

Like LEEN, the LNTN began life in County Hall and then moved to a large, 20,000 square feet, building in Camden in 1984. Set back from the road the nature of the building design did not encourage a walk-in atmosphere. Up to half of the space was for small factory units for start-up enterprises involved in new technologies, for example, a women's new technology co-operative and enterprises involved in electronic music systems, and interactive literature computer software. In addition there were workshop facilities for technical projects funded by the GLEB, an exhibition/meeting area and a canteen. The LNTN was officially opened in 1984 by Neil Kinnock, the leader of the Labour Party, and launched with an open-day exhibition depicting the technological facilities and interests of the Network.

a) Background.

LNTN was established to focus on microelectronics and information technology. Human-centred technology was of particular interest. Dr.M.Cooley, Director of the Technology Division at GLEB had been a pioneer in this field in the UK together with Professor H.Rosenbrock of UMIST. It also figured strongly in the Lucas Plan (see Wainwright and Elliott 1982).

The case had been made by Cooley (1983) and others that new machine and data-control systems using computers could be designed to enhance workers' skills and creativity rather than displace them or lead to redundancies. In the context of Computer Aided Design (CAD) Rosenbrock argued:

> We need not develop CAD systems which refuse to use the special skills of the operator and the special properties of the human mind. We can instead develop systems which will accept the skill of the user and collaborate with it to increase productivity. We need not develop flexible manufacturing systems which fragment and destroy the machinist's skill. We can allow that skill to develop into something new. The same can be said of office automation and, to the extent that it is not too late, to printing. Such professional areas as medical diagnosis will offer the same kind of alternative choice. This I regard as the most important challenge facing engineers and technologists in the next twenty years. (quoted in Cooley 1983 p.28).

Rosenbrock continued to pursue research in the field at human-centred technologies at UMIST and GLEB with the involvement of LNTN maintained a strong interest. In 1986 the GLEB were awarded £1.8 million by the EEC to oversee a human-centred manufacturing project under the EEC's ESPRIT Programme in liason with UMIST and other research institutions.

In the GLC General Policy Document (GLC 1982) it was acknowledged that there was a need to address the problem of new technology for industries in London, but the emphasis was on this 'human-centred' approach. The aims of LNTN were to encourage the application and development of 'new' technologies in a socially-useful way. New technology refers to those areas of recent rapid development including microelectronics, computer technology and software development, and its spinoffs in the areas of information technology, robotics, automated manufacturing systems and so on.

During its initial stage the LNTN attempted a process of co-operative management, but increasingly after September 1985 became more formal and hierarchical (Interview-Sheen 1985). This was as a response to directives from the GLEB for tighter administration following the curtailment of their own funds at the beginning of 1985 when preparations began for the abolition of the GLC. The interview at LNTN took place after this period in December 1985. The Co-ordinator of the Network was unavailable at that time and so the interview was carried out with one of the full-time workers; John Sheen.

b) Policy.

The general brief for the Network was the socially-useful application of new technology. An important aspect of this function was the 'demystification' of computing technology for lay persons. This meant making the facilities and personnel of the Network available to trade union and community groups. In addition, education and training programmes in new technology were run. The Network was particularly concerned to promote equal opportunities in employment and ran an EEC funded microelectronics training course for women.

The objective of the exploration of the social use of computing and computer-related technology was to democratise and pool information resources for use by community groups and other organisations. An understanding of the possible alternative applications of new technology which could enhance the quality of work was seen as important ,support work for trade union groups in bargaining for New Technology Agreements and the alternative implementation of new technologies in the work context. The LNTN provided general advice and services to the other networks concerned to apply new technology to their products and services. For LNTN the emphasis was on the application of new technology rather than invention/innovation of hardware, products were in the form of computer software packages. Thus product development and innovation was focused on computer software and the development of socially-useful computer programs . (Interview-Sheen 1985).

c) Day-to-day operations.

The LNTN was a company limited by guarantee. The Network was funded by Technet Ltd. of the GLEB, but in 1985/1986 was expected to achieve an average of thirty per cent funding from external sources. For LNTN this took the form of EEC funding for new technology training for women and ethnic minorities. The Network Council had nineteen members at the time of interviewing comprising representatives from community groups, trade unions and colleges. The Chair person was Anthony Hoskyns who had been involved in I.T.E.C. and was described as an 'entrepreneur with politics' (Interview-Hales 1984), a person who was skilful at drumming up support for the Network and getting in business, but who also was sympathetic to the role of LNTN as a community-level resource centre. The Council was the decision-making body for the Network and responsible for overall policy. There was a core staff of twenty-five people which included nine engineers, a site-manager, a production manager, creche workers, consultancy staff, two outreach workers and a co-ordinator. Following the pressure for tighter administration five people had been taken on. At this time monthly progress and review of project reports were fed to the GLEB and continued funding was dependent on the achievement of objectives and agreement on project development with the contact person at Technet Ltd.

The Network was product-based and concerned to achieve some balance between commercial concerns and non-commercial projects. In this way finance could be raised and ploughed back into the Network to subsidise the socially-useful content of their operations; the open access and free use of facilities to local community groups. For projects a strong emphasis was on marketing and project evaluation before prototypes were supported.

d) User involvement.

User involvement in the Network on product development was work with single inventors on particular projects which were referred to the Network. For example the AMIC, a keyboard for autistic children to use to learn music was referred to the Network from Clive Sinclair's programme on Capital Radio. An inventor from the Blind Houseworkers Guild with a project for a high sensitive microphone for cot deaths was also referred indirectly. User involvement also took the form of support for the small co-operatives and other enterprises housed on the site. There was some emphasis on small-scale advice on technology problems to groups that were referred to the Network either from the local boroughs or from the other Networks. Links with the community were developed through training programmes, such as, the women's training course. The physical make-up of the building was important, it had a large exhibition/meeting area that was hired out to local groups and others for meetings. In this way the Network established links with the Ethnic Minorities Unit, Grant Crisis in Camden and Electronics for Peace. The strategy for user involvement in the Network was reactive, the Network waited for people to contact them, rather than pursuing a strong local outreach orientation (Interview-Sheen 1985).

e) Access to technical resources.

The links with the Polytechnics or Universities was based on working on particular projects. This was mainly with Imperial College who were joint partners with the Network on a project on diabetic care. The Network tended to employ its own engineering staff for research work on other projects. In this way it was a centre of expertise in its own right rather than an interface between local groups and the higher education institutions.

The links with the GLEB were for finance and monitoring. If approached the Network was willing to assist with GLEB firms but at that time they had no real input. Any links that did exist reflected a fragmentary approach to individual projects, as in the work with the London Production Centre mentioned below, rather than any clear overall strategy. The respondent also added that there were; 'No great links with GLC sector strategies either, there is a dislocation between theory and practice, that is, the EPG sector analysis and strategy and the practical day-to-day management of the Network' (Interview-Sheen 1985).

f) Socially-useful products.

The main areas of exemplary projects were in the field of 'expert systems'; knowledge based computer systems. It was envisaged that the computerisation of information on, for example, diabetic care and other medical areas could be of use to general practitioners in community health care - this project was in conjunction with St. Thomas' Hospital and the City University.

Another area for the socially-useful application of new technology was in the link-up between small inexpensive computer systems used by community groups to facilitate the pooling of information. A project involving the development of cheap computing networks for domestic and community use/schemes linked St Mary's College computing expertise with LNTN.

At the London Production Centre, one of the GLEB's

Technology Centres, LNTN was involved in work on control engineering for educational robots for a company set up as a spin-off from Imperial College. The work was helping to develop LNTN's control engineering expertise, and was relevant to further development of educational robotic products, emphasising the human-centred approach to systems design.

For LNTN the promotion of socially-useful applications of new technologies has centred around attempts to demystify these technologies by providing training and allowing access to interested groups. The nature of exemplary projects in the form of expert systems was largely research-based. The Networks were increasingly under pressure to gain external funding and this led to a tendency to emphasise the product-based nature of the network as against the community level resource centre model. Thus the Network had the facilities but operated in rather an ad hoc way to the community as it did not have a developed political context. In 1986 the Network became involved in litigation with the GLEB over reduced funding and finally closed in 1987.

6.5 TRANSNET.

Transnet was the latest network to be established. Discussions began in July 1984 and the Network became operational in January 1985, it was housed in the offices behind the GLEB in Avonmouth Street. In addition to office space, shared with the Intermediate Technology Development Group (ITDG), Transnet had access to the London Energy Centre workshops located on the ground-floor of the building. Due to the comparatively late start for the Network in terms of the time-scale of this research project, the interview with the Co-ordinator; Colin MacDonald, took place only three months after the Network had become operational. For the other Networks, a period of at least six months had elapsed before interviews were carried out.

a) Background.

Transnet differed from the other Networks in two ways; first, it had developed directly out of a campaign against the closure of the London Transport (LT) Bus Repair Works at Aldenham and Chiswick, and second, it was largely policy-oriented. Its brief was employment support and research into transport policy issues. Much of its work was specialist information and campaign support for trade unions and community groups involved in action against redundancies and cuts in services in the public transport sector in London. The founding of the Network as part of the campaign against redundancies at the London Transport works meant that Transnet began operations with a firm focus on alternative production to bus repair and maintenance. The campaign began because the London Transport Works at Aldenham was facing closure. LT were concerned that the large building which incurred high running costs was not being used cost-effectively. Transnet developed links with the trade unions and the management to look at alternative uses for the space and equipment that would save the threatened redundancies. One idea was to use the height of the building for lifting buses to give easier access for maintenance and repairs. Working with the GLEB to restore economic viability to the Aldenham and Chiswick works, the partly completed chassis and tools for the Ward Chassis, a multi-purpose vehicle chassis was bought from the receivers of Ward Motors Ltd. This new product was aimed at small bus and coach manufacturers because of its low floor, easy maintenance and low cost. Its manufacture would serve to retain jobs at London Transport Engineering. However, the campaign foundered once London Transport was no longer the responsibility of the GLC but of central government in the form of London Regional Transport (LRT). Talks broke down, largely as a consequence of the introduction of government legislation for LRT which prohibited third-party manufacture in their engineering works (Interview-MacDonald 1985).

b) Policy.

Transnet focused on transport technologies. The aim of the Network was to encourage socially--useful and responsible planning and implementation of transport policy. In addition a quarter of their time was spent on the development of socially-useful technologies to fit this policy, for example, the Pedelec Stella, the electric bicycle developed in the LEEN workshops was an example of a product that fitted their remit.

The consideration of the socially-useful potential of products was based on their overall design in the context of a socially-conscious transport policy. The Network was concerned to address the problems of transport service provision for the disabled, low-income groups and women; groups that were considered to have special needs. For example, Transnet supported development of the Mobility Bus; a crew-operated bus with modifications for wheelchairs that would increase public access for the disabled and the elderly. The Network rejected the promotion of high-technology transport in preference for simplicity and effectiveness. The capital-intensive nature of support for high technology was beyond the Networks financial capability and, more importantly, did not fulfil the social objectives of employment retention and creation.

The remit of employment retention and creation was considered to be most effectively pursued by campaigning, research work and the support for workers'plans. Thus, Transnet devoted the majority of their time to looking at ways to integrate transport policy ideas in a socially-useful way and launch an effective lobby for their implementation.

c) Day-to-day operations.

Like the other Networks, Transnet was a company limited by guarantee with a membership of trade unions ,transport pressure groups like Transport 2000, local authorities, academic institutions and the GLEB. The membership was comparatively small, in relation to LEEN for example, so that all of the member nominees of Transnet were also Council members. The Council were the decision-making body for Network policy, project assessment and recommendations for project support. Permanent full-time staff managed the day-to-day operations. Transnet had a core staff of eight full-time and one part-time, and a collective working structure. Two staff members were responsible for the co-ordination of administrative and development work. Other staff had responsibility for specific areas such as public transport, freight, employment support, new technology and publicity. For example, research work on the development of a freight policy was based on the GLC sector strategy study of public transport, but looked at in a more detailed and practical way to include legislative requirements and constraints on railway sidings and waterside storage. Where possible the Network drew support from academic institutions, and sometimes used paid consultants.

Transnet had been organised as a network which devoted three-quarters of its resources to campaigning and the promotion of socially-useful transport technologies. Product development accounted for the other quarter.

The Network produced a quarterly newsletter describing their activities, encouraging community campaigns and reporting on changes to transport services in London.

In its first year the Network received funding of three hundred and fifty thousand pounds, of which nearly half was set aside for specific projects. Funding was from the GLC through Technet Ltd. of the GLEB and dependent on close monitoring of financial and project performance. This source of funding was severely cut by the abolition of the GLC, but the Network benefited from the London Boroughs Grants Scheme (LBGS) which gave it substantial support. In 1986/7 it provided all of Transnet's revenue and project budget (Green 1987).

For Colin MacDonald, the Co-ordinator of the Network, the question of continued funding was on the Network agenda in its very earliest stages (Interview MacDonald 1985). By and large, the nature of the funding that could be procured from various sources would delineate the future nature and approach of the Network to transport issues. There were several possibilities that could be pursued, first, the Network could act as a support to small businesses which may generate revenue and thus ensure that work could continue in the public transport sector; a major employer in London. In this way the Network could act as an interface and campaign resource for a suitable transport system acting as a public service, and concerned with individual and group transport needs. It was recognised that if the Network were to become self-financing then this would mean that it would have to accept products that were not socially-useful but which may generate income. The problem was seen as that a fair proportion of their work was policy-oriented, and that they did not have the resources for effective product development.

MacDonald (Interview 1985) did not see the Network developing as a consultancy service because they were limited to specific information and were basically a community resource type organisation. One avenue that would allow this type of development and ensure the continuation of projects with a socially-useful content was access to revenue from charitable trusts for specific projects for the blind and disabled. At this stage this avenue had yet to be explored.

d) User involvement.

The Network was not involved in product design and development with user groups. Where possible, they assisted projects that were referred to them from the Economic Policy Group (EPG) at the GLC and the GLEB. For example, the Network supported projects that involved the movement of freight by water and so were able to assist a firm engaged in moving sand and stone up the Thames estuary to London, with commercial and business advice and finance, in partnership with the Co-operative Bank, to purchase a boat.

User involvement more usually took the form of links with workplace and community groups on campaigns against job losses and service cuts. The Network were able to assist with alternative proposals for products and services and with publicity and promotion of campaign work. For example, they were concerned to promote the concept that buses with conductors are more attractive to passengers and therefore that additional wage costs are recovered from increased business activity.

The development of participation in the Network was dependent on a lot of ground work and was a slow process. It involved building contacts through working with trade unions and/or community groups on specific issues and the burden of proof was on the Network to demonstrate their ability to provide an effective resource (Interview-MacDonald 1985).

e) Access to technical resources.

Transnet were concerned to expand their contacts with Polytechnics and Universities. It was found that academic institutions were not as supportive as first envisaged in the proposals for the Networks, thus they needed more facilities and equipment than their own resources initially catered for. Nevertheless, some links were established, usually through specific projects. For example, a small firm using the LEEN workshops worked with the Polytechnic of the South Bank on 'Hush-kits'; modifications to heavy goods vehicles to reduce noise. In this case, product development was a result of legislative requirements imposed by the GLC for vehicles travelling through London at night. Transnet also had links with the Polytechnic of Central London through membership of its Council, this form of link was very dependent on individual commitment rather than a considered policy by the Polytechnic.

MacDonald (Interview 1985) felt that the links with the other Networks was fairly good, Transnet were able to advise Thames Technet on transport projects and LIN on electric vehicles. With LEEN there was a good exchange of information. However there were no links between LNTN and Transnet.

f) Socially-useful products.

The design and development of alternative products that offer constructive alternatives to unemployment takes time to build up. For project development, the funding links with the GLEB and the GLC meant that usually projects were referred from these organisations or through individual London Boroughs. The projects would then be assessed by the Council to see if they fitted the Network remit and could be considered socially-useful in some way. MacDonald (Interview 1985) noted that this was often a difficult decision, on first reflection a project may display a number of advantages which are lost on closer examination. This proved to be the case with a project for computing equipment to aid routing for taxi drivers, at first the advantages to be gained were for passengers to more easily share taxi journeys and fares. However, a more in-depth assessment revealed that this type of equipment could be used to deskill the taxi-driver. The Network were committed to the view that new technology should not be used to deskill or reduce employment. This was not the case for the Hush-kits project noted above, here local legislation stimulated the demand for an innovation that was found to be commercially and environmentally desirable.

The remit of employment creation for the Network was felt to be more easily achieveable by campaigning against job losses and service cuts. Job creation was seen as a necessarily slow and long-term process. However, the Network could aid employment creation indirectly by the provision of business advice services, and by facilitating access to finance. In addition, the campaign-oriented base of the Network meant that they were less prepared for commercial developments than some of the other Networks. The initial commitment to social-use led them to downplay any marketing development for the Network, this was seen as largely irrelevant at the time.

For new product development the commitment of large investments was seen as beyond the Network's scope, this was particularly true for new technology investments. However, the Network was concerned to support the development of low-level technologies, for example, a steel hull work boat.

This form of boat lasts longer and requires less maintenance than the fibre-glass models which are currently favoured by boat-builders. The market which stll exists for steel hull boats is filled by the Netherlands, but Transnet argued that this project could bring work and employment to the London area. Support for this project was linked to the campaign for a freight policy that looks toward rail and water rather than road transport.

A further project was the development of an Underground information presentation for the blind. This project was aimed at the social market; London Regional Transport and some local authorities. A further bonus would be if the product could be manufactured in London.

Transnet were concerned that their promotion of socially-useful transport technologies and their campaigns for the better use of existing transport facilities, for example, the canal system, formed an integrated approach to transport policy. The network recognised the importance of looking at transport policy from the point of view of disadvantaged groups, particularly the disabled and elderly, and environmental concerns; for example, pollution and traffic congestion.

The financial constraints imposed by the abolition of the GLC meant that commercial considerations would have to be given a higher priority by Transnet. Ideally, the social market was the area to address, however the financial constraints for this market segment meant that it had a comparatively low potential for income generation, thus the Network were concerned to plan their development with a careful combination of both commercial and social objectives. MacDonald (Interview 1985) felt that the identification of the best way that this could be achieved would also provide the model for the future development and role of the Network.

6.6 THAMES TECHNET.

The South East London Technology Network; Thames Technet, was an area-based Network located in South London serving the London Boroughs of Greenwich, Lewisham, Southwark, Lambeth and Bexley. The Network began life in 1983 and was based at Thames Polytechnic for its first year. It took nearly twelve months to get the building in Warren Lane, Woolwich refurbished and working. The building comprised office space, innovation workshops, a creche and a canteen, and was accessible to a range of locally-based user groups. The workshop facilities were designed to house a number of start-up units for local enterprises. At the time of interviewing the Network had been operational in this building for seven months. The interview was carried out with Julie Betteridge, the Co-ordinator of the Network.

a) Background.

The Network was formed in 1983 and had particular links with the Mechanical Engineering and Continuing Education Departments of Thames Polytechnic. The Director of the Polytechnic was keen to be seen as supportive of the initiative and housed the Network for its first year. The initial proposals for the Network were, first, the equipment side to be organised as a community facility, and second, daily working arrangements to show how technology could be used to the benefit of the community. During this period activity in the Network concentrated on fieldwork; the basic groundwork of compiling lists of supporters, liaison with the local boroughs to establish links and ensure a two-way flow of information, and building contacts among the community groups in the South-East London area. The area-based Networks differed from the other three Networks previously described in that they did not have a particular product focus. These Networks were more directly reliant on the local community. The model of the Networks as community-level resource centres was particularly applicable to Thames Technet.

b) Policy.

Betteridge (Interview 1984) summarised the aim of Thames Technet as to act as a practical resource for individuals, groups, co-operatives and other enterprises on the development of products and services that were relevant to the needs of the local community. A special emphasis was put on the encouragement among users of the Network, of a critical attitude to technology issues and the appropriate use of technological resources for community organisations. The focus on the accessibility of the technological resources in the Network was seen as the means by which local people could begin to use the equipment (comprising mostly of simple machinery and welding gear) and, through informal training, to assess their views about the nature of technology and its relevance and use to their daily lives.

The organisational structure of Thames Technet emphasised a strong community bias both on the Management Council and amongst the full-time staff, who were divided into Technical and Community Teams. The Technical Team comprised individuals with specialist skills who were responsible for the operation of the equipment in the workshops. The Community Team were responsible for liaison work with the local boroughs, the assessment of the resources and needs of the area and the building of links with community and voluntary organisations. This orientation evolved from the commitment among the Board of the Network to examine the cultural context of technological projects, that is, to ensure that projects reflected the needs and concerns of the community rather than more abstract notions of social-use embodied in physical products. This was described in a recent article by Pam Linn, a member of the Board of Thames Technet since its inception;

'Our intention was to engage in more egalitarian forms of production, as it is broadly conceived and, in the process, produce goods and services which took account of the culturally specific needs of consumers' (Linn 1988 p.126).

c) Day to day operations.

In the same way as the other Networks, Thames Technet was a company limited by guarantee. It had a membership and representatives from the membership were elected onto the Board or Council. In this Network the Board comprised five representatives from community organisations including local trades councils, employment and race relations groups. In addition there were two representatives from local authorities and two from Thames Polytechnic. The Network Board met every six weeks and was largely concerned with policy-making. Criteria for project assessment were developed which took account of the aims of the Network and project proposals had to be approved by the Management Committee and the Network Board of Directors.

The day-to-day management of the Network was the responsibility of the full-time staff. The Network employed five full-time and two part-time staff, the latter were an accountant and a cleaner. They were in the process of advertising two new posts in electronics and mechanics. Betteridge (Interview 1984) emphasised that the work in the Network was organised on a collective basis with weekly meetings to co-ordinate the day-to-day management.

The full-time staff were divided into Community Teams and Technical Teams. The educational and employment backgrounds of the staff in these teams reflected the technological division of labour, that is, the community team was made up of non-technically trained people with backgrounds in social work, teaching, and personnel. Betteridge (Interview 1984) noted that although the Network was committed to attempting to break down some of the divisions between technical and non-technical, there was a difficulty in recruiting staff with a mixture of skills; that is, with both a technical and social/economic interest in technology issues. The reassessment of the 'technical' requires a reassessment of gender divisions (the technical is often synonymous with male domination) and the divisions of labour. The Network attempted to address the problem of how to overcome these divisions but acknowledged that they were reflected in their own Community and Technical Teams. Working arrangements were made to attempt to breakdown some of these divisions, for example, they developed a policy of an open form of working with users. The Technical Team were encouraged to adopt a 'hands-off' approach to informal training in the workshops allowing users to operate the equipment themselves and only assisting on request.

The Network received funding of four hundred and fifty thousand from the GLEB. At the time of interviewing this was on a monthly basis for the Network as a whole rather than by project. These funding arrangements were to be maintained until June 1986. After the abolition of the GLC the Network were assured through the GLEB that funding would be obtained from the Association of Local Authorities (ALA). However this funding would only cover the running costs of the Network, and money for projects would have to be found from other sources. To some extent this would mean a continuation of operations that were already practiced in the Network. Since its inception the Network had established links with local council Economic Development Units, and local Co-operative Development Agencies (CDA) and acted as a facilitator to gain funds for projects and users of the Network. For example, the Network were able to assist, in liaison with the local council, on the provision of grants and loans for users seeking to benefit from the MSC Enterprise Allowance Scheme.

Betteridge (Interview 1984) argued that the nature of the work in the Network, assistance to users and the outreach work that this involved incurred hidden costs which meant that it would not be possible for the Network to become wholly self-financing. It was impossible to evaluate their work on a short-term basis, getting money back from projects through royalties or licensing arrangements requires a long lead time, although at some point in the future if they were lucky with a few good projects then it may be possible for the Network to become partly self-financing. Another possibility was the organisation of the Network on a consultancy basis, and to sell skills, which may allow a balance between social and commercial projects to be achieved.

d) User involvement.

The workshop facilities were used to provide informal training in the use of welding gear and other equipment. Facilities and enterprise unit space were free to small start-up enterprises, especially co-operatives, for the first three months. The Network policy was to ensure that the facilities of the Network were a community resource, thus the space was used for meetings of local groups and there was also the capacity to house small enterprises.

Thames Technet were concerned to act as a resource and catalyst for local enterprises which were initially housed and then helped with feasibility and development work leading to a business plan with which to approach the local council Economic Development Unit or Co-operative Development Agency. In this way the Network were able to directly assist with employment creation by helping enterprises to get started. Examples of the type of enterprise housed were a small business involved in the adaptation and design of fashion clothes for disabled and outsize women. The Network were able to provide some funding which was matched with money from one of the local councils to allow this business to get off the ground, they were also able to provide the facilities necessary to stage a small fashion show. Blackwell Products, was a co-operative making a low-cost aerobic composter and other gardening and recycling products. After an initial period in the Network this co-operative moved into its own premises but still used some of the resources at the Network, for example, computerised mail order. Two catering businesses began life in the Thames Technet canteen. One of these businesses;Tropicana, was able to gain experience, benefit from user feedback, check pricing policies and advertising techniques for a four month period in the Network before developing a considered business plan with which to apply to Lewisham Council for help with premises and funding.

The creche in the Network was for users' children, in addition the space was used for meetings on various issues including opportunities for women, and employment and training for black women in Lewisham.

e) Access to technical resources.

Because of its beginnings in Thames Polytechnic and the commitment of the Director to the initiative, Thames Technet were in a good position regarding their links with the Polytechnic both from the commitment of time from academic staff, technicians and researchers and with a variety of student projects. For student projects the Network acted as a link between the Polytechnic and community groups to facilitate the exchange of project ideas. Although the exchange of resources with the Polytechnic was good and was particularly marked in electronics and mechanics, some of the time the Network had to pay for resources, this would usually take the form of accessing expertise by the employment of a consultant from the Polytechnic. An effect of the cuts in the Polytechnic Department budgets was that it was important for them not to be seen to have excess capacity (Interview-Betteridge 1984).

The links with the GLC and PPU were quite strong on a personal level, this was useful to the Network as an information source and sometimes they were contacted by people who had been referred by the GLC. The links with the other Networks were only cursory, the funding situation meant that the Network tended to be rather more inward looking.

f) Socially-useful projects.

The Network had a mixture of projects, only some of which were actual products in the form of hardware. Certain core projects had long-term aims, such as a project on vascular diseases and diagnostic techniques in collaberation with Thames Polytechnic. As part of this project the Network were involved, with Dulwich Hospital, in the funding and vehicle side of a mobile X-ray screening unit for the local community.

The links with community organisations served to yield product and service ideas.. In response to the needs of the disabled, representatives of Greenwich Action for the Disabled developed plans for creative play equipment for handicapped children and a quick, efficient wheelchair repair and modification service.

The South London Scrap project sought to identify the scrap availability in the area, this was supported as a community project that could be converted into a product or service.

The Toys Workshop Venture was a community-based enterprise, brought together during its development stages via, Thames Technet, Greenwich Employment Development Unit, Greenwich, Lewisham and Bexley Toy Libraries and Spurn House Resettlement Unit. The aim of the enterprise was to provide a range of appropriately designed and produced toys which would take into account the learning needs of both able and disabled bodied children.

A pilot scheme for the assessment of the potential need for a local information data-base or resources directory for the exchange of equipment, such as, photocopiers and information among community groups in South London was underway with funding from the local borough councils.

Another project with Thames Polytechnic on mobile bulk-handling equipment for unloading ships was directly product-based. The Network were able to assist with the funding of the first stage of the project, for product prototype development by a local company, for the next stage of production and manufacturing then the GLEB were approached for venture capital finance. Aid with product development was based on agreements between the producers and the Network on initial funding, loans and repayment conditions, and licensing or royalty arrangements.

For Thames Technet the focus was on socially-useful products that were directly community-based and had employment potential. The close relationship with the community allowed the identification of needs that were not necessarily met by the development of new products.

6.7 THE LONDON INNOVATION NETWORK (LIN).

The London Innovation Network (LIN) acted as an umbrella organisation for the Product and Employment Development Agency for North and East London (PEDNEL), the Design Development Unit (DDU) at Middlesex Polytechnic and the Comunity Construction Design (CCD) linked with North-East London Polytechnic, other organisations were created at later stages of the Network's development. In the first instance PEDNEL was the only organisation of the Network, it began life in 1983 in the buildings of North London Polytechnic. Its aim was to encourage local community and trade union participation in the Network. The DDU, with its commitment to socially-useful products via student projects, and the CCD were design and product oriented organisations. The amalgamation of these organisations became the LIN. Thus as a Network it attempted to combine area-based and technology-based activities.

The LIN moved to refurbished buildings on the Holloway Road in 1984, there was office and workshop space geared to prototype development and small-batch production. The interviewee was Mary Moore, the co-ordinator of the administrative side of the Network. Since the Network has developed quite substantially since interviewing took place the information is up-dated from secondary sources.

a) Background.

In their initial stages the organisational development of the Networks were dependent on the political and practical concerns of the staff. In PEDNEL the core-staff were largely political; that is, community and trade-union campaign-oriented with virtually no product base. In large part this resulted from the creation of the Network as an area-based organisation in the same way as Thames Technet. The absence of a product focus in their development brief meant that more emphasis was put on community participation than products (Interview-Moore 1984).

The re-organisation of the Network in 1984 led to LIN as an umbrella organisation and central resource for affiliated groups in North and East London. PEDNEL continued its outreach and community work. The DDU was established at Middlesex Polytechnic in May and based in the Craft, Design and Technology Department. Student projects were initiated to provide a design and product prototype development service to the Network. For the DDU and the CCD, linked to North-East London Polytechnic, product design was identified as a key point of intervention in the innovation process and central to attempts to direct product development towards social needs. Of particular importance was design flexibility so that products could be adapted and modified to meet particular needs. Thus from the time of its establishment, over a two year period the Network moved from being almost wholly community-based to being almost wholly product-based.

b) Policy.

After re-organisation the overall objective of the LIN became very clear. Technology transfer; the linkage of product ideas from academic institutions or other groups in the community to local enterprises comprised the central thrust of LIN operations. Of prime importance was the practical work involved in the identification of needs and the development of products and services aimed at the social market, and with direct job creation potential. This meant a policy of co-ordination with other agencies associated with the Network or to local councils, such as Economic Development Units, to secure adequate funding for prototype and product development, through to manufacture, preferably by local enterprises; new start-ups or co-operatives.

The emphasis on product design and the use of design to accommodate particular needs represented a commitment to socially-useful products but also to the social process of design. LIN was keen to support projects from individuals and groups not usually associated with the design process, for example, project ideas from women and ethnic minorities. Moore (Interview 1984) argued that the practical example of this type of project was important to attempts to dispel the view that inventors are largly white and male (see, for example, the electronic aid for the deaf in GLEB 1985a). Educational provisions for craft, design and technology teaching were seen as a possible direction for the Network to take in its concern to positively involve the local community in the product design process.

The policy of practical technology transfer work was reflected by the developments at LIN after the time of the interview. Coleman and Amphlett, both central figures in the Network, presented a paper to the Brighton Technology Conference in March 1987 which listed the series of autonomous and semi-autonomous agencies and units which together made up the Network:

The London Innovation Network (LIN) functions as the nucleus of this network, providing workshop, office and overall management and financial services to projects and agencies, as well as publicity and specialised project management, particularly in the field of patents, licensing and technology transfer.

Community Construction Design (CCD) is an independent agency specialising in technology management and product development. It has a substantial track record in the fields of building and transport, and has provided senior management for the Network as a whole. CCD's experience in technology management, licensing and patenting has proved especially useful, and CCD personnel take overall responsibility for technology transfer within the Network.

The Design Development Unit (DDU) located within Middlesex Polytechnic is a product development agency which works in close collaberation with the Craft, Design and Technology department. Trainee teachers gain useful experience working on the development of new products for the educational and medical markets. Some of the Networks most successful projects have originated there.

LIN Marketing Group provides market research and promotional advice to all LIN projects, and makes its services available to co-operatives, local businesses, local authorities, and other organisations associated with economic development. The unit has organised conferences and product launches, and currently maintains a watching brief on the London furniture industry for the GLEB.

LIN Disability Unit (DU) was established in the summer of 1986 as a focus for project work in this field. It has close links with the London College of Furniture's disabled design course, and many other agencies and groups servicing and representing disabled people. The unit has successfully completed a long term product development programme which has resulted in an award-winning design for seating systems for special schools, and is currently engaged on similar programmes of work. It is intended that the Unit will eventually become autonomous and self-supporting financially.

LIN Design Aid Service (DAS) was also established in the summer of 1986 and provides technical, design, marketing, and financial support for small companies, co-operatives, community organisations, schools and colleges, carers (home helps, mothers, nurses and so on) and trade unions. Many individual and groups working in these fields have sound product ideas which they are unable to either develop or exploit for lack of knowledge, resources, or specialist information. DAS makes an initial assessment of people's ideas and then seeks to either provide or identify appropriate resources or assistance to turn the idea into a manufacturable product. Success in this type of innovation is never high, but LIN's distinctive hands on approach has already proved itself effective (Coleman and Amphlett 1987)

c) Day-to-day operations.

The search for a practical and effective way of fulfilling the Network brief led to a decentralised organisational structure for the LIN. The network of affiliated agencies and units meant that it was possible to incorporate a wide range of activities into the Network without creating a mound of bureaucracy. The LIN were concerned to act as a central resource that operated with a minimal organisational infrastructure located at the Holloway Road buildings.

The Network Council included representatives from GLEB, North London Polytechnic, Middlesex Polytechnic, Islington Council, Hackney Council, and two PEDNEL Directors. The Council grew as representatives from the other organisations involved in the Network joined at a later stage. The Council was responsible for the general policy-making in the Network, project appraisal and resource allocation.

The Network received funding of four hundred and fifty thousand from GLEB Technet Ltd., and with careful accounting were adequately funded until September 1986. Thereafter they would need to approach the London Boroughs Grants Scheme in the same way as the other Networks had to do after the abolition of the GLC.

The Network employed thirteen core staff, this large administration base was necessary for their work as a central resource to the different agencies. In the main the core-staff were concerned with processing product proposals and securing funding for product proposals emerging from their agencies. The Network had three full-time employees in the workshops and were able to draw on a pool of ten to twenty consultants when necessary. In the first two years from approximately 400 project ideas, five were taken through to full production (Holdsworth 1988).

At the stage of interviewing at the Network in late 1984, Moore (Interview 1984) acknowledged the problems of taking projects forward and monitoring project development adequately. The day-to-day realities of manufacturing decline were tangible and visible, and the Network staff faced the problems of operating in a competitive market economy. Firstly, there was a need to develop marketing and entrepreneurial skills if enterprises were to survive the realities of a competitive market. The recruitment of staff with a mixture of technical or business skills and an ideological commitment to socially-useful product and service development proved to be difficult. The educational and working backgrounds of the staff tended to be in the youth work, caring and teaching professions. The Network had recruited two people with some marketing skills but in general lacked hard-nosed business experience.

A second problem was the availability of manufacturing opportunities. The Network did not have the resources to arrange manufacture, this would have incurred large costs in terms of premises, re-tooling and so on. Moore (Interview 1984) noted that there were only 24 manufacturing co-operatives in London, mostly in labour-intensive areas. The development of links with the commercial manufacturing world meant addressing the problem of whether the networks were subsidising the research and development work of the private sector. Employment creation in the London area suffered when the problem of manufacturing opportunities meant that it was necessary to approach companies established in other parts of the country; for example, the Whitfield Bench, a technology bench for the education furniture market that was developed by the DDU and LIN, could only be manufactured by a company outside London.

d) User involvement.

The projects that flooded into the LIN came from a variety of sources, but by and large were from white male individual inventors rather than trade unions or community organisations. For Moore it was important not to just look at something as a socially-useful product, there was the need also to see where it came from. The context of project identification, formulation and eventual use was central to the socially-useful concept. The Network had the commitment but work was needed to find ways of making it happen. Moore was against the idea of the Network as a cheap reseach and development resource between inventors and the commercial world (Interview 1984).

As part of the commitment to a high level of user involvement and supporting research the project 'Disability and the Domestic Environment' began as an investigative outreach programme in the autumn of 1984 (this work fed into the LIN Disability Unit formed in 1986). The aim of the project was to involve interested groups and build a picture of the needs of the disabled that would provide valuable background information for product development. The identification of gaps in existing aids and equipment availability, together with research into the problems of the disabled community, could then be used to initiate projects in the Network that would raise awareness of the needs of the disabled and begin to explore channels through which they could be met. The contacts made with the groups revealed the need for a mobile repair service for aids for the disabled and the elderly. The project established by LIN provided an example of the type of local authority service required if there were the commitment of resources to this area.

The LIN also made contact with a group of physiotherapists working in Islington and teachers working for the Inner London Education Authority (ILEA). Outreach work of this nature was more successful if meetings were arranged around specific projects or issues. Community involvement in the social process of design and innovation was not an automatic process once the facilities had been created. To aid the process there was general exhibition work in town-halls and libraries, and the Network put together a publicity pack that emphasised the resources available at the Network for community and workplace group support and confidence building around problem-solving and design.

At a later stage of its development the Network were able to offer technical and marketing support to local co-operatives and enterprises looking to develop new products. A future aim was the identification of successful ways of funding the process of technology transfer, in its broadest sense, at the point of application, that is, on specific product development programmes tailored to meet the needs of individual enterprises and at the same time supply identifiable social markets (Coleman and Amphlett 1987).

During its process of development the LIN built up a pool of expertise around product development and innovation of low and medium level technologies. The involvement of the seven agencies in the Network provided an extensive source of contacts on individual inventors, research projects and product development agencies which the LIN were keen to make available, on a consultancy basis to similar agencies, projects and local authority departments working in the field of economic development, such as, local Economic Development Units and Enterprise Boards (Coleman and Amphlett 1987).

e) Access to technical resources.

The access to technical resources in the Polytechnics was initially a slow process. Moore (Interview 1984) described them as; 'large institutions that are not easily shifted', their attitudes to the Network were built by, and dependent on, the personal commitment of individuals. The breakthrough in this activity for the LIN was made by a policy of affiliation to agencies located within Polytechnic departments and based around student projects on a variety of areas including design, technology, marketing and business. LIN developed strong links with the City of London Polytechnic which led to the creation of the Business Enterprise Unit, and with the Polytechnic of North London, through PEDNEL, another of its agencies. PEDNEL was integrated into the Polytechnic as a specialist product development unit working with departments and individuals in the Polytechnic and the local community. The Disability Unit which provided a specialised focus for project work in this area had a close link with the London College of Furniture disabled design course (Coleman and Amphlett 1987).

The DDU at Middlesex Polytechnic was involved in technology transfer as part of the LIN, and thereby made the resources in the Polytechnic available to individuals and industry. Products were developed in the Polytechnic and placed with manufacturers. The Whitfield Technology Bench was an example of this activity and eventually led to the Polytechnic developing educational furniture to manufacturers requirements (see Holdsworth 1988).

Coleman and Amphlett (1987) in the paper mentioned above describe another strategy followed by the Network that involved the launching of new initiatives through which technology transfer could take place from polytechnics into the industrial and commercial community. This work focused on the establishment of R and D companies operating within London polytechnics. For example, City Science Ltd. a bio-technology company which grew out of a collaborative work between the City of London Polytechnic and Flag Brewery Co-operative. LIN contributed to this initiative both in financial and advisory terms. The LIN were concerned to encourage Polytechnics to look beyond their academic concerns for effective and practical forms of application of their technical expertise.

f) Socially-useful products.

The strategy developed for socially-useful product development by the LIN was to focus research in the fields of disability, education, transport and medicine. As with the disability project mentioned above product needs were identified by working with groups of end-users. End-users were also involved in testing and commenting on ideas, designs and product prototypes, for example the disability project discovered the lack of provision for particular domestic aids and housing modifications. The strategy was evident in the development of the Whitfield Technology Bench where in a case-study of the development Holdsworth (1988) described working with Craft, Design and Technology teachers and local authority education departments on the product brief and design. The product was then tested by kitting out a school. In this way, Holdsworth (1988) noted that significant and proven markets for the Networks products were identified as part of the development process, this ensured the required interest from manufacturers who were made confident of sales and customer satisfaction.

By extensive research work and user involvement the aim was to achieve a balance with products between social-use and commercial marketabilty. Whilst social markets represented a respectable niche for agencies like the Network, these markets are already serviced by sometimes very large manufacturers, thus new product ideas needed a strong competitive edge. Employment creation via new product development was the area where the commitment to socially-useful production met the necessity of commercial and economic viability if enterprises were to survive. There was care to ensure that products met a special need but were also generally attractive to a wider market. For example, Playbox was designed to alleviate the problems of inadequate storage space in creches and nurseries. The wooden box unfolded and unpacked to become an assortment of different play shapes and equipment. Work began on the box in November 1984 and it was hoped that this product, along with other wood-based designs would be sufficient to establish a small woodworking co-operative in the London area.

The Network also supported individual designers and inventors whose ideas fell within its socially-useful brief, especially when other sources of support were not readily available. The initial response from the LIN was a free 'design surgery' which offered advice on product ideas. If the potential of the project appeared favourable then support would be given for a feasibility study and market assessment. If the results of this were encouraging then funding was sought for its design, development and prototyping, through to pilot batch production and product launch. In return for this support, LIN took an intellectual property stake in the product or technology under development (Coleman and Amphlett 1987).

Some examples of LIN products are described below:

A plug-in micro-computer interface for the Sinclair Spectrum was developed in collaboration with Haringey Enterprise Board and the originator. LIN were able to ensure the transformation of the idea into a saleable product which led to the establishment of a small business supported by the Enterprise Board.

The 'Neater Eater'; a device designed to assist people with diseases resulting in muscle tremor was developed by an individual inventor, LIN, and developed in collaboration with Imperial College London, the National Hospital for Nervous Diseases, and the Challey Heritage. Commercial manufacture was launched through a new business start-up.

The Wheelchair Mini-Gym is an exercising machine for weight training and rehabilitation to be manufactured by Hoskins Ltd. of Birmingham under licence.

The Cloudesley Chair is an adaptable seating system unit that caters for the needs of children with disabilities by the provision of a correct seating posture to facilitate their participation in school activities. This product was developed by LIN and Kanwal Sharma with the collaboration of the London College of Furniture and the Training Workshop Resource Unit. Extensive field trials took place with potential users in two special schools, and an agreement was negotiated for the Chair to be manufactured and distributed under licence by Taylor and Son (Orthopaedic) Ltd., of Walsall (Coleman and Amphlett 1987).

6.8 COMPARABLE ORGANISATIONS.

At this stage it is worth mentioning two organisations that were similar to the London Technology Networks; Sheffield Centre for Product Development and Technological Resources (SCEPTRE) in Sheffield and the Unit for the Development of Alternative Products (UDAP) in Coventry. Interviews were carried out with Jim Shutt from SCEPTRE and Bill Brook from UDAP in 1984. The collection of comparative data from these organisations was as an aid to understanding for some of the issues that emerged from the Technology Networks. The information collected from these organisations is used in Chapter Seven.

SCEPTRE; an organisation similar to the technology networks in London, was established by Sheffield City Council Employment Department as a resource centre and interface between Sheffield City Polytechnic and the local community. The focus of the centre was on product development and the provision of technical advice and support to local enterprises, especially co-operatives and community based organisations.

SCEPTRE acted to support local enterprises throughout the process of start-up by the provision of technical support for product development, premises in the form of sheltered workshops and marketing and organisational development support. Particular attention has been paid to marketing where the links with the Polytechnic's Economics and Business Studies Departments have proved invaluable.

In a similar way to the London Technology Networks, it was found that access to the resources within the Polytechnic, both expertise and facilities involved a lengthy period of negotiation and were very dependent on individual commitment and the political orientation of the department. Where expertise was required, the staff at SCEPTRE aimed to tap specialist activity that was complementary to the expertise within the Unit. The product ideas that emerged from Polytechnic departments tended to be rather crude prototypes. SCEPTRE used their own resources for applied engineering to create something more tangible from these prototypes that was geared toward the market and user needs and capable of manufacture.

An example of the type of product development that this organisation aimed for was the Advanced Humidifier System. This product emerged out of a joint venture between the Polytechnic, tenants organisations and a local co-operative established by some of the workforce after the closure of their firm manufacturing machine tools. The local authority housing department, under pressure from tenants to act on problems of condensation in its housing stock provided an initial market.

The Unit for the Development of Alternative Products (UDAP), mentioned in 6.2 had a different background to SCEPTRE. It was first established in 1981 with sixty thousand pound funding from the Cadbury Trust to work on some of the product proposals that emerged from the Lucas Plan. It was located in the Engineering Department of Lanchester Polytechnic and had developed a good working relationship with this department on student projects.

When the WMCC took office in 1981 it supported UDAP in a bid to foster the manufacture of alternative products in the

West Midlands. This allowed the Lucas work to continue, mostly in the area of electric vehicles, together with activities geared to the processing of project ideas from the local community. UDAP used product ideas to initiate student projects; for example, in the Engineering Department when specialist engineering expertise was required. For marketing and business planning support for local enterprises and co-operatives, links were made with the Business Studies and Graphics Departments of the Polytechnic,and student projects working with client enterprises were initiated.

UDAP was also involved in work with some third world countries on particular projects. For example, they used their workshop facilities to develop a brick-making machine for Zimbabwe and worked with the Eritrean Relief Organisation on problems of energy sources. In addition, there have been some attempts to establish links between local enterprises and Third World countries requiring products. UDAP were seeking funding from the EEC Social Fund for a project that would involve a local engineering firm in the design and refurbishment, with second-hand machinery, of a workshop built in a shipping container for use in India. The refurbishment of second-hand machinery that is reliable, serviceable and with easy access to spare parts is a particular need for developing countries who tend to experience service and spare part problems with existing machine tools.

Both SCEPTRE and UDAP were operating in the same field as the Technology Networks, though tended to be more directly product-based. However they shared some of the same problems which will be discussed in Chapter Seven.

6.9 TECHNOLOGY NETWORKS - SUMMARY AND CONCLUSION.

This description of the technology networks and their activities highlights the range of alternative developments both in organisation and focus that emerged during the policy implementation process. At the outset, it was envisaged that the technology networks would provide the facilities for technology transfer from academic institutions to the community, and provide a conducive environment for the exercise of the tacit knowledge of community and workplace groups. What would emerge would be a socially-directed innovation process that was based on the close links between producers and users.

The objectives of the promotion of socially-useful technologies, user involvement in product development and employment creation were addressed by the networks in different ways.

For LEEN it was found that the prime consideration for energy issues was the provision of information and advice on energy efficiency and conservation measures plus some technical work. Employment creation could best be obtained by campaigning to change policy on energy issues that would lead to the political and financial commitment to implement the socially-useful technologies that already exist.

For LNTN the exploration of the socially useful applications of new technologies, particularly in the area of computing, and the development of prototype alternative applications was the main focus. Open access to the network's resources, equal opportunities in training programmes, were important to the aim of the demystfication of new technology. Employment creation was in the form of nurturing small start up enterprises.

For Transnet, the integration of a socially-concious transport policy with the socially-useful technologies meant that campaigning work was the largest area of activity. As in the case of LEEN, employment creation could best be achieved by information directed toward changing attitudes.

The above networks were centred around products and issues. The area networks developed differently because of their links with the community, the emphasis was particularly on the identification of appropriate technologies for use by local groups and local enterprises. Thames Technet was perhaps the most closely involved with community-based projects, and was concerned to promote socially-useful technologies by encouraging a critical attitude to technological development. The nurturing of small start-up enterprises housed in the network was seen as important to the creation of employment.

* LIN exhibited the characteristics of both an area and product based network. The central focus for this network was on design and the transfer of design products from academic institutions to local enterprises. The problems of manufacture and markets that were encountered in facilitating this process are discussed more fully in Chapter Seven.

The technology networks acted as catalysts for the transfer of knowledge and ideas into employment creating projects with especial emphasis on the prototype and product development stage of the innovation process.

However, by 1987, particularly as a result of the abolition of the GLC and subsequent funding problems, the Networks were facing difficulties and were dependent on the limited resources of the London Boroughs Grants Scheme for their continued survival. In 1986 Thames Technet and Transnet were reduced to token staff only. After surviving for some months on a monthly funding basis which prohibited any real planning for project development Thames Technet closed. The premises were handed over to the Business Innovation Centre.

Both LNTN and LEEN closed in 1987 after facing funding difficulties, the remainding LIN, perhaps the most well known of the Networks through magazine and television coverage, closed in March 1988 as a result of GLEB's inability to keep up the lease on the Holloway Road workshops. Nonetheless, because of the nature of LIN's organisation, Holdsworth a key figure in the DDU remained optimistic, he noted that; 'In April 1987 LIN were faced with a funding crisis that meant staff redundancies, however the majority of the development agencies remained in one form or another, and these actively continue to develop projects by establishing project pools of charitable and industrial finance against an initial division of intellectual property rights' (Holdsworth 1988). If this comment is not already out-of-date then the possibility of continued development of agencies associated with the LIN remains. At the time of writing, of the Networks which formed the case-study, only Transnet remains in operation.

Despite their short life, what emerged strongly from the technology networks was their catalytic role in linking inventors with funding agencies, and linking products to manufacturers. Their operations spanned four years, in which time much work was initiated and developed on avenues for socially-useful product development, investigations into the needs of end-users and the potential of social markets. This experiment in product development of social-use, environmentally safe and good design; that is, products which closely reflect user needs, comprised an alternative solution to technological and social problems.

In Chapter Seven an evaluation is made of the experiment in terms of the networks experience of user involvement in product design, technology transfer between the Networks and the Polytechnics, and socially-useful product development. The evaluation is in the Networks own terms and looks toward a clearer understanding of the policy implementation process rather than any assessment using objective standards of success and failure. To proceed in that direction was deemed inappropriate in this context given the short time scale of the Networks operations and the difficulties of tangible measurement of outcomes from social organisations like the Networks. Thus in the next chapter policy implementation is located in the background of the historical, economic and political context of the policy formation and other secondary data is drawn on as an explanation-building aid for the technology policy process.

CHAPTER SEVEN: CASE-STUDIES: ANALYSIS OF FINDINGS.

7.1 INTRODUCTION.

The case-studies of the Technology Networks are the basis of this study of the implementation of a technology policy based on social need. The findings illustrate the differences between the Networks and their approaches to user involvement in product design, technology transfer between the Networks and the Polytechnics, and socially-useful product development.

In the Methodology (see Chapter Four), the view of policy as tentative theory about the nature of social processes and the workings of social institutions was put forward by Majone (1975).

The research hypothesis was:

User involvement in the selection, design specifications and development of products, together with access to technical resources are the key components of a socially-useful technology policy.

Exploration and evaluation of the research findings rests on whether the Technology Networks achieved the objectives set out in the initial policy statement:

a) user involvement in product design,

b) technology transfer between the polytechnics, networks and the community,

c) innovation of socially-useful products.

In this chapter the technology network policy is explored in the Networks own terms, that is, were the GLC and the technology networks able to achieve the objectives of their own policy formation.

In 7.2 the research findings are discussed in relation to the day to day operations of the Networks. The models which emerged from the policy implementation process variously emphasised a technology or a community-based perspective, and a campaigning or a practical socially-useful product development perspective to technology policy. In 7.3 the interim policy outcomes are presented. Following this the chapter is divided into sections of user involvement, technology transfer and socially-useful products.

This chapter offers a locally-based analysis of the research findings, that is, consideration is made of the agencies directly involved in the policy process. The comparative data collected from Sheffield and the West Midlands is compared to the findings from the Network study. This enables a distinction to be made between general problems of the technology policy approach and those that were specific to the GLC/GLEB initiative. In addition, the discussion incorporates other alternative technology initiatives where some similarity of issues and problems are apparent.

7.2 Models of the Technology Networks.

The central tenet of participation in a socially-useful product design/development process suggests a wholly product-oriented approach for the alternative technology policy. However, the findings presented in the case-studies suggest that this was not necessarily seen as the best means of approaching the Technology Network brief. The day-to-day operations of the Networks exhibited the realities and contradictions inherent in their working as social institutions for product design/development.

The problem in the Network brief was that of the 'cart before the horse'. In various ways the Networks found that socially-useful product development was dependent on user participation. The access of a different range of social groups of users and producers to the early stages of the product design process maybe a valuable exercise in itself but not without its problems, the largest being how to actually achieve that participation. The question emerges as to which comes first, community participation; a political strategy, or product development; a practical strategy which contains its own difficulties in terms of the economic and political problems of manufacture and markets.

Mike Hales, a member of the Economic Policy Group at the GLC identified four models for the Technology Networks which illustrated the problem of the mix between political and practical elements of the strategy:

1. Trade union/community support - back up research to political campaigning by workplace groups and community groups. This model was exemplified by CAITS, which became known as a centre of expertise for workers' plans and socially-useful production.

2. Utopian campaigning or technological agitprop - the Networks as the technical means of satisfying social needs through the development of socially-useful products to prototype. The aim, to use exemplary projects as the basis for campaigning and promotion for alternatives to the present direction of technological change. This model could be applied to UDAP in Coventry which emphasised practical product development through student projects.

3. Job creation by technology transfer - alternative commodities for viable commercial development in start-up or failing enterprises.

4. Restructuring for Labour - analysis of the local economy and planning for socially-useful investment. Here the local state is seen as a 'force of capital' which gives a funding led character to initiatives.
(Quoted in Holdsworth 1988).

The proposals for the Networks (see 6.2) contained both political and practical elements, and the existing organisations; CAITS and UDAP offered practical examples of the approach. The mixture of a practical 'technical' approach and a political approach was largely dependent on the political and ideological orientation of the individuals concerned with running the Networks. The product-based and area-based character of their briefs compounded the differences. Thus, conflicts inherent in the strategy between these elements and the aim of developing a focus for the individual Networks was particularly apparent in the early stages of development. For example, LEEN began operations as an umbrella funding organisation, and as already noted in the previous chapter, for many of the alternative energy organisations their interest was in social and technological change and energy policy issues, rather than 'new products', thus the product concept was sometimes unclear. It was only at a later stage that a focus which more easily fits Models 1 and 4, but which contained practical product elements also was developed. The LIN began life as PEDNEL, an almost entirely political organisation similar to Model 1, after re-organisation it became more focused on the practical elements of the strategy exemplified by Model 3. LNTN also most closely resembled model 3 in its day-to-day operations but contained elements of Model 2 for its 'human-centred' approach to new technology, and Model 1 in its educational programmes. Transnet was concerned to maintain a campaign focus with analysis for socially-useful investment and mostly resembles Models 1 and 4. Thames Technet most closely resembled the community level resource centre of Model 1, the conflict between the political and practical elements of the strategy was reflected in their Community and Technical teams.

What this typology suggests is that the technology policy was approached by the Networks in a number of different ways. It was not the case of a straightforward implementation of the policy proposals for the Technology Networks. Why this was the case will be more fully explored in the following sections. The use of Hales' models to identify the variety of orientations exhibited in the Networks indicates that they cannot be simply lumped together and discussed as representative of a unified strategy. The main elements in the propositions were dealt with quite differently as the staff in the Networks attempted to put a technology policy based on social need into practice. It must be remembered that this was in the context of increasing political pressure on the GLC itself (see Chapter Three).

It would be an oversimplification to argue that because the Networks were unable to put the policy straightforwardly into practice that the policy was flawed. Whilst this may be the case, what is more helpful is to explore how the Networks implemented the main elements of the strategy given that user participation and the spare capacity in the Polytechnics existed in the beginning as idealised concepts only.

7.3 INTERIM POLICY OUTCOMES.

Policy outcomes differed substantially between the Networks, and from the policy propositions. By policy outcomes I refer to the major findings from the policy implementation process. Before summarising these findings in a series of statements, a note of caution is required. It must be remembered that the Networks all faced funding crises following the abolition of the GLC, and this affected their role as social institutions. All were under pressure to adopt a more commercial approach to product development and consultancy activities, with the ultimate aim of becoming self-sufficient organisations. In effect, funding difficulties led to their closure, with the exception of Transnet, as indicated in Chapter Six.

Policy outcomes are referred to as interim, first because they refer to the findings from the period of this research project. Second, because if the GLC had not been abolished the Networks may have developed differently and to a longer time-scale. Potential policy outcomes, had this been the case, can only be open to conjecture.

Summary of Outcomes:

The political/practical elements in the Networks were prioritised in accordance with the product or community brief and the perceptions and aims of social-use, as identified by the individuals centrally involved in their organisation.

Participation required a pro-active approach built around specific issues or localities and was a slow process, particularly around the articulation of social needs.

User involvement spanned a spectrum of activities from membership organisations, campaigning to product development.

Product ideas more usually emerged from white, male inventors than from any other group. Product development remained the preserve of student projects and technically skilled people.

The notion of spare capacity within Polytechnic departments was misconceived. Polytechnic links were more easily forged around particular projects or through agencies located in Polytechnic departments themselves. The commitment of interested individuals was an important pre-requisite.

There was a difficulty with recruitment of personnel with the correct mixture of skills; marketing and entrepreneurial skills together with community/voluntary work experience and a commitment to the idea of socially-useful production.

The employment creation brief meant that products needed to display both social-use and commercially viable characteristics. Difficulties were compounded by a lack of manufacturing opportunities and public sector markets.

Production for the social market required a social organisation of the innovation process which built on the relationship between producer and end-user. Whilst the Networks could provide this mechanism, markets were limited by the cut-backs in public spending. The mechanism did not exist whereby purchasing power was directly related to need. The nature of the competitive market mechanism constrains the possibility of creating and developing products in an alternative way.

Short-term political priorities of the GLC were in conflict with the longer-term process of innovation.

Need-led innovation is a political problem. There is not a problem with the technology, but rather with the commitment of resources for implementation.

A lack of clarity surrounds the concept of social-use. Its narrow definition as product-based obscures its political elements which include education and training, campaigning and hands-on use of technological equipment. Deference to scientific and technical expertise, the exclusive nature of technical skill, the realities of the power relations which surround technology in everyday life - all diminish the possibilities for a genuinely participative approach to innovation.

It is important to note what the Networks did achieve, as well as what they did not. In the initial stage of their development, the concept of a 'technology network' was unclear. The Networks had to build their own political constituencies. In addition, user involvement and links with the Polytechnics required a lot of groundwork and were in no way automatic processes. Through the policy implementation process the best way to approach the idea of a socially-useful technology policy began to emerge. Links were made with the Polytechnics, often around specific projects, and through active outreach work, some participation and user involvement in the Networks was achieved. Product development was particularly evident within LEEN and LIN.

More important, however, was the identification of the central elements necessary to a socially-useful technology policy.

The Networks developed in different ways, but taken together the findings suggest that campaign work, education and training in the use of equipment, access to information and the promotion of discussion around technology issues were key requirements for a genuinely participative approach to technology policy. These forms of cultural and technological programmes were necessary to the objective of user involvement in product design and development.

In sum, the creation of the facilities for user involvement in product development by themselves, and technology transfer of socially-useful products from academia to local enterprises were not found to be the most important factors for an alternative approach to innovation. These elements comprise components, rather than are the basis of, a socially-useful technology policy. In the following sections, why this was found to be the case is discussed.

7.4 USER INVOLVEMENT IN PRODUCT DESIGN AND DEVELOPMENT.

The social organisation of the product design process, whereby producers and users had the facilities to work together, was a key element of the GLC technology policy. The Networks represented the creation of an alternative mechanism to the 'market' for a more direct relationship between producers and users; an important pre-requisite for an alternative approach to innovation. The major focus for the Networks was the design and development of socially-useful products, together with exemplary projects which extended technological opportunities to otherwise disadvantaged groups, for example, training in new technology for women and ethnic minorities.

The IEC Report (GLC 1982) described in 6.2 outlined the brief for the Technology Networks. One aim was the involvement of representatives from the scientific community, locally-based workplace groups, representatives of the local community and other voluntary groups concerned with the development of socially-useful technology, in their management and day-to-day operations (GLC 1982 p.3). The Network staff were to make appropriate contact for people in the community to make use of the facilities of the polytechnics and universities for their own research and development needs. The aim was to discover ways of organising the design process so that socially-useful products could be developed.

As a proposition, user involvement in product development is based on the belief that people who use technologies and are affected by design decisions should be involved in making those decisions. This is a concern which has been reflected in debates on technology issues for much of the 1970s (see 2.7). In a similar way to the concept of participation, the notion of user involvement lacks clarity. It can refer to exercises designed merely to elicit users opinions about product development, for example, in the way of market research techniques. Or at the other end of the spectrum, it can refer to product design and development by users themselves. The latter involves a transfer of power from the 'expert' to the lay-person, and necessitates the provision of workshop facilities for product development. Whilst workshop facilities were made available for user involvement in product development, the nature and extent of this involvement varied among the Networks.

The Technology Networks were based on the ideas of production for social need characterised by the Lucas Plan (see 5.4). Social needs identified by discussions with community groups were linked with the skills, equipment and resources at Lucas Aerospace. In this example, users were not actually involved in product development; that remained the preserve of the skilled workers at Lucas Industries.

What was different was the access to varying degrees of influence for a range of workers and social groups to the design/development stage of the innovation process.

What is important about an attempt to evaluate the extent of user involvement in product development achieved by the Networks is the recognition of the varying degrees and forms that it can take.

A brief resume of the forms of user involvement pursued by the Networks indicates the different ways that this objective was put into practice. The energy network, LEEN, gave priority to the promotion of energy efficiency measures and services. They worked with local authorities, tenants groups and voluntary organisations involved in energy issues. The Network staff sought to compile information of particular relevance to tenant groups and, in this way, build alliances around energy efficiency needs. This was achieved by a deliberate strategy of seeking to recruit community organisations and trade union branches into their membership. Their strategy for participation by users tended to be pro-active and centred around specific issues and specific localities such as a local authority housing estates. User involvement in product design and development was indirect in that ideas for products, such as the user-friendly heating controller, emerged from discussions with organisations involved in energy issues. Otherwise, product ideas were initiated by sole inventors, in the case of Pedelec and Airlec, or people already employed in the Network. The concern was to develop products with a social-use potential, identified through discussions with tenants and energy groups, that was matched by strong indicators of commercial viability.

LNTN were involved in education and training programmes in new technology, for example, microelectronics training courses for women. User involvement in the Network also took the form of support for the small co-operatives and other enterprises housed on the site. On product development they tended to work with single inventors referred to the Network from other agencies, or they worked on particular projects in collaboration with university departments. The strategy for user involvement in the Network was reactive in that they waited for people to contact them, rather than pursuing a strong local outreach orientation.

TRANSNET were concerned to represent the transport needs of the disabled, low-income groups, women and other disadvantaged groups. They emphasised the political campaigning element of the Network strategy and were not directly involved in product design and development with user groups. Where possible, they assisted projects that were referred to them from the EPG. User involvement more usually took the form of links with workplace and community groups on campaigns against job losses and service cuts, publicity and promotion of campaign work. This was a slow process and involved building contacts through working with trade unions and /or community groups on specific issues and the burden of proof was on the Network to demonstrate their ability to provide an effective resource.

THAMES TECHNET sought to act as a practical resource for individuals, groups, co-operatives and other enterprises on the development of products and services relevant to the needs of the local community. The Network emphasised the accessibility of its technical resources for use by the local community. To this end a Community Team pursued a strong local outreach strategy.

LIN emphasised the close relationship between producers and users on product development with projects such as 'Disability and the Domestic Environment'. This was an investigative outreach programme designed to involve interested groups in drawing a picture of the needs of the disabled. The identification of gaps in existing aids and equipment availability, together with research into the problems of the disabled community, could then be used to initiate projects in the Network. Product needs were identified by working with groups of users. End-users were also involved in testing and commenting on ideas, designs and product prototypes. The products themselves were designed and developed by people with the appropriate expertise. The Network was keen to support projects from individuals and groups not usually associated with the design process, for example, project ideas from women and ethnic minorities, but found that project proposals were by and large from white male inventors rather than from women, community organisations or other groups.

This resume indicates the spectrum of user involvement from organisational membership, participation in campaigning, educational programmes to informal training and use of machinery, discussion of needs and hands-on development of products. LIN most clearly attempted the latter but found that product development was the preserve of existing inventors and student projects in the polytechnics. In effect, products were developed by people skilled in the use of technology.

In a recent article Linn (1988); a key figure in Thames Technet, argued that the inability of the technology strategy to effectively open up the product design/development process to users was the result of the GLEB 'product-focused technicist view' of social change which was not genuinely built on the needs of local people. What was required was an understanding of the social and cultural factors which shape technological artefacts in the context of existing power relations of race, gender and class. It was crucial to base a genuinely alternative approach to innovation on the realities of our technological environment. She argued that;

'local people have little access to technology, or to the power that accompanies conventional technical knowledge and productive facilities' (p.126).

For Thames Technet the focus was:

'not a design-led vision of social change, but an attempt to change technological working relations by minimizing exclusive expertise, valuing non-certificated experience and making productive resources available to a wider range of people' (p.134).

To some extent the problem with user involvement emerges from the political/practical dichotomy discussed in the previous section. For users to be involved in product design/development then what is required is a slow process of building links, informal training in the workshops and the opportunity for a 'hands-on' participation. This requires a transfer of power from the 'expert' to the lay-person in an attempt to influence technological working relationships. However, the practical emphasis on product development and the political pressure for the Technology Networks to demonstrate the workability of the alternative approach with actual products, to a large extent, precluded the approach that was called for by Thames Technet. Indeed, in her article Linn suggests that the GLEB were actively against the community approach, in that funding for projects was more readily available for product-based rather than community-based projects. This was not suprising, given the political pressure on the GLEB to demonstrate to ratepayers the 'value for money' of their approach to technology policy. However, it does draw attention to the important truth that the resources were unavailable for the development of a genuinely participative approach to innovation.

From the users perspective the product-oriented approach is compounded by the nature of skill and expertise. Design can be perceived as a 'solution-focused' activity (Walker 1986) that is based on the identification of a problem. The difficulty with the encouragement of user involvement in product design is the ability of non-designers to generate new possibilities. Product design involves technical knowledge but, just as importantly, is also based on experience and observation. Ideas for changes and improvements to products and processes are unlikely to emerge from lay persons without some technical experience in particular product areas. The remoteness of technology from everyday life in the sense of the lack of participation in technological development that is engendered by the privatisation and specialisation of the innovation process, together with the increasing technical complexity of many technologies results in a tendency to reinforce attitudes of deference to technical and design expertise.

Deference to expertise is socially and culturally familiar to our society, user involvement in product design is not. Thus to achieve some measure of participation the Networks had to adopt pro-active strategies and strong outreach programmes. Given that it is unusual for users to be able to pinpoint the nature of their dissatisfaction, an emphasis was put on the establishment of links with community organisations that could begin discussions on the nature of their particular product needs. This was also a point taken up by Linn (1988), in the article mentioned above. She questionned the notion of popular planning as an effective and culturally familiar activity, arguing that since we live in a privatised and individualised times, how is it possible to find a context within which popular participation does not look culturally strange, and is accessible and credible as a way of winning something. Second, popular planning denys political or interpersonal conflict. Third, on a more practical note, participatory structures assume that working-class people have the time and energy to become involved in local authority and municipal experiments.

The problems that Linn points to in terms of popular planning are those that were experienced both in the Popular Planning Unit and the Technology Networks. Groups that did become involved in the technology networks tended to be those already involved in technology issues. Otherwise, the people most likely to approach the Networks were single inventors rather than groups of users or producers. In part this can be explained by the fact that the context of the local authority is qualitatively different from the experience at Lucas Aerospace (which was influential in the establishment of the Networks) where alternative plans for socially-useful products integrated the skills of manual and professional workers, in a context of struggle against management plans for rationalisation and redundancy. The Networks were required to build their own focus and political constituencies. It was envisaged that through a process of popular planning and workplace planning product ideas would emerge from groups of workers threatened with plant closure via GLEB, or community groups contacted by the GLC's Popular Planning Unit. The GLC's Popular Planning Unit was established to stimulate local debate on specific needs and problems in general; this was patchy and did not lead to much involvement in the GLEB innovation programme. Indeed this is not suprising and supports Cockburn's (1977) point that middle-class, more affluent groups with a history of participation in resident associations and other local and issue based organisations are more likely to take up opportunities for participation in planning than more working class groups (see 5.5). This was a finding from the Popular Planning Unit at the GLC and led to the policy of building on existing initiatives rather than the promotion of popular planning in general (see 5.8). This strategy was also evolved in the Networks, whereby LEEN and Transnet sought to build on existing campaigns and form alliances with groups already operating in the field of transport and energy.

While direct community participation in the innovation process has been patchy, the GLC's various consultative exercises and the 'local plans' developed with the help of the Popular Planning Unit have at least provided an input into the GLC/GLEB decision-making system. Obviously, it takes a long time to build links and the danger with the product-oriented Networks particularly was that products would be based around existing technical capability rather than user needs.

7.5 TECHNOLOGY TRANSFER.

A broad definition of 'technology transfer' is 'the institutional or geographical movement of product or process technologies from one sphere of economic activity to others' (Marshall 1987). Liff (1985) defines technology transfer as 'a form of innovation which does not require the firm applying the new technology to undertake original research and development work' (p.5). 'Technology transfer' may encompass a number of differing practical approaches. In terms of the GLC approach, it refers to the transfer of ideas and products from academic institutions to local enterprises via the Technology Networks. It was envisaged that higher education institutions would collaborate with the Networks on the identification of product needs and the support of projects at the prototype and product development stages. Specifically, it was seen that:

'the Networks would encourage undergraduate and post-graduate projects on product ranges that would be useful to the communities around them' (GLC 1982 p.3).

In this way academic theoretical design and technical skills could be matched with the 'tacit' knowledge of workplace and community groups (see 6.2). The product prototypes would then be produced and manufactured by GLEB supported enterprises and co-operatives.

In practice, this process was not straightforward. The idea that the Networks could link into the spare capacity within Polytechnic departments was misconceived. In part this can be attributed to the funding crises facing Polytechnics. The pressure for academic staff was to win paid research contracts, thus many were reluctant or unable to give unpaid time. The emphasis on Polytechnic/industry links and the self-sufficency heralded as the way forward for Polytechnics meant that extra-curricula activities were required to bring in funding from outside sources, for example, training courses for industry. Consequently, the Polytechnics tended to look towards the GLEB as a possible source of funding for 'research', rather than as a partner in developing ambitious new social projects. It was found by all of the Networks that links were very dependent on contacts, personalities and individual commitment.

Institutional commitment to the Technology Network was in no way automatic. Links were forged more easily by working on a particular problem that was relevant both to the polytechnic and the networks, rather than more generally on a day-to-day level. For LNTN links were established with Imperial College through work on a joint project on diabetic care. Rather than rely on linkages the Network tended to employ its own 'experts', thus establishing itself as a centre of expertise in its own right rather than as an interface between local groups and the higher education institutions. The same policy was adopted by Transnet, links were established with the Polytechnic of the South Bank on particular projects. An upshot of the difficulties of access to technical resources in the Polytechnics was that the Networks needed more facilities and equipment than their own resources initially catered for. Thames Technet had a different experience with Thames Polytechnic largely because it began its life within the Polytechnic itself and received support from the Director. They found that commitment of time from academic staff, technicians and researchers was good, and a number of student projects were initiated. However, on occasion the pressure on the Polytechnic not to be seen to have excess capacity meant that time from academics had to be paid for on a consultancy basis. The LIN were perhaps most successful in establishing links with the Polytechnics and initiating student projects as a result of their policy of affiliated agencies actually located in Polytechnic departments and based around student projects, such as the DDU at Middlesex Polytechnic and the CCD at North-East London Polytechnic. For LIN partnership arrangements with polytechnic departments was seen as mutually beneficial, in return for access to polytechnic resources they provided a source of challenging 'real life' research projects for students of design, technology , marketing and business (Coleman and Amphlett 1987). Again this resulted from the commitment of individuals, rather than emanating from the institutions themselves. The LIN were concerned to encourage Polytechnics to look beyond academic concerns for effective forms of application of their technical expertise and development. One strategy was the establishment of R and D companies operating within the Polytechnic (Coleman and Amphlett 1987). The LIN would then assist the final stage of technology transfer by seeking new enterprises or co-operatives to manufacture the products. This strategy was more attractive to Polytechnics because it matched their concern to establish more effective links with industry and the community in a commercial, rather than voluntary sense.

Technology transfer from the DDU and CCD and projects developed in the Networks to local enterprises presented certain problems. First, there was the need for Network staff to develop marketing and entrepreneurial skills if new and assisted enterprises were to survive in a competitive market. The survival rate of new small firms developing new products in the current economic climate cannot be seen as encouraging. A difficulty for the Networks was the recruitment of staff with a mixture of marketing and entrepreneurial skills together with a commitment to socially -useful products. In general, the staff of the networks were from academic and technical backgrounds - with only a small number of personnel recruited with non-technical backgrounds or business experience. In addition, the emphasis that emerged on campaigning as part of the networks' brief necessitated a bias toward political mobilisation around technology issues. Whilst Thames Technet attempted to address this problem, the difficulty of finding people with skills in both technical areas and community mobilisation was recognised.

A second problem was the availability of manufacturing opportunities. The GLEB and the Networks did not have the resources to undertake manufacturing in terms of equipment, tooling and premises. The LIN found that there were only 24 manufacturing co-operatives in London, mostly in labour-intensive areas. This raised two issues; the development of links with the commercial manufacturing world meant addressing the problem of whether the Networks were subsidising R and D work for the private sector. The Networks were established in a concerted attempt to link the technological resources of local colleges and polytechnics to meet the strategic social, economic and employment needs of the community. As such they represented a clear alternative to the practices adopted in Science Parks, where academic expertise is channelled to meet commercial requirements (see 3.3). However, the problem of manufacturing opportunities meant that the Networks were forced to operate more like Science Parks. Employment creation suffered when the problem of manufacturing opportunities meant that it was necessary to approach companies established outside London.

This above point is most clearly illustrated by a case-study of the Whitfield Technology Bench by the Co-ordinator of the DDU (see Holdsworth 1988). The DDU identified a market for a technology bench through involvement with Craft, Design and Technology teaching. Further discussions with teachers/users and LEA's revealed that existing engineering and woodworking shops were inappropriate for technology teaching. The production of a small batch of technology benches was undertaken in the LIN workshops. A school was then kitted out with the Bench. This allowed feedback from users to identify any design modifications and acted as a demonstration unit for potential manufacturers. For production and marketing of the Bench the base concept was to find a manufacturer in London who could produce the product whilst paying a royalty per unit sold. The first priority was to find a manufacturing company involved in the GLEB Furniture Sector Strategy or a company within the GLC area capable of providing a complete manufacturing facility in-house, with a sales operation that could expand into the educational market. After a period of visiting manufacturers, it became apparent that to obtain the best deal it was going to be necessary to manufacture the Bench outside the London area. At this point Holdsworth notes that the possibility for the GLEB or LIN to establish a remote sales and production facility to produce and market this and other furniture products was considered. However, this would have been a costly exercise, and funding for this approach was never accessible. In addition, it went against the GLEB and LIN philosophy, they saw themselves as aides to the production process, and not producers per se. In terms of the best deal for the product a manufacturer in Worcester was chosen with a track record in the field of educational furniture. Shortly after the completion of negotiations, the company was taken over by one of the larger educational furniture manufacturers who decided to add the Bench to their product range, manufactured under licence with LIN in receipt of royalties. Whilst the royalties received from the Bench would feed back into the DDU and the LIN, and thus subsidise other projects more directly relevant to the people of London. This case-study illustrates most directly the key problems of the 'technology transfer' approach; manufacturing and employment creation.

7.6 SOCIALLY-USEFUL PRODUCTS.

Socially-useful production as a political strategy for technological development was strongly influenced by the Lucas Plan (see 5.4) and the socialist ideal of usefulness over profit. It provided a means to relate technology directly to social need through products such as aids for the disabled. Second, it represented a vision of an alternative and prefigurative paradigm that could present a different role for technology in society. The pre-figurative element was a strong factor in the GLC approach to popular planning, workers' plans and socially-useful products (see 5.2). Of prime importance was the ability to find a way to exert some influence on the direction of technological advance and the benefits that flow from it. To do this it was necessary to produce both a critique of the current shape and aims of existing technology together with examples of alternatives that could lead to social and technological change.

This alternative technological paradigm was fostered by the GLEB's Technology Networks initiative with the potential use of resources; materials, energy, capital and labour to meet social needs in a more effective way than they are currently catered for. The ability to transcend existing forms of thinking about technology by building on the tacit knowledge and experience of workplace and community groups, what M.Cooley, the Director of the Technology Division at the GLEB termed the 're-integration of hand and brain' was seen as the way to stimulate more socially relevant and technically sensible ideas. The Technology Networks were established to provide the facilities for this alternative approach to technology and innovation.

Before considering how the Networks approached the idea of socially-useful production it is necessary to try and clarify the concept. In an article on the GLEB, Newman (1986) argues that;

'In order to have an unambiguous meaning the concept of socially-useful production is best reserved to cover those products which would not be produced under a capitalist market system because they require state involvement in research, development, distribution and purchase'(p.63).

What this implies is an alternative economic system to the 'market' for the production and distribution of goods within the public sector. It calls for the public sector to be the stimulus for technological and economic change. This definition of socially-useful products is a narrow one, but does identify the central elements of the socially-useful approach, as applied to the public sector.

It is necessary to attempt a definition because otherwise the concept can become an all-encompassing one. Rustin (1986), in a review article points to the ambiguities surrounding the concept of socially-useful production in the London Industrial Strategy (GLC, 1985). He argues that:

'First, the use of capital and especially labour resources in contrast to their disuse through redundancy and factory closure - show that creating useful work would cost little and less than maintaining the unemployed. This argument alone is almost sufficient justification for many kinds of public involvement.

Second, Socially-useful production is contrasted with privately useful, this signifies a preference for those goods which are actually used in common, for example, launderettes as opposed to domestic washing machines.

Third, a distinction is made between goods and services allocated by public or political decision and those allocated by the market, a general preference is for public over private spending.

Four, Socially-useful products will be consciously chosen as such by workers, for their known use-value, in contrast to production in response to impersonal market forces or exchange values.

Finally, sometimes socially-useful is simply taken to be what everyone can agree it is. As such it represents an evocation of an invisible collective, initially the common culture of a particular community or workers' group'.

These ambiguities indicate a general notion of socially-useful as the re-introduction of capital and labour resources into the economy through public sector political processes. Goods, aimed at collective service provision, in effect, take the form of what can be commonly agreed to be socially-useful. As one commentator remarked, 'it is perhaps easier to agree on what is not socially-useful rather than what is' (Brooke - Interview 1985).

For the Networks the major problem was how to find a way of promoting the ideal of socially-useful production with real-life exemplary products, whilst at the same time attempting to create employment amidst the realities of operating within a competitive market system. Certainly, the aim of producing products for the disabled and influencing the allocation of public spending away from armaments to medical equipment is attractive. But, to create employment through this process requires an increase in public spending, precisely what is missing in Thatcherite Britain.

An alternative approach was to balance the social-use and commercial attractiveness of products developed in the Networks. Some of the projects taken up in product form by the Networks were ideas from sole inventors. A problem for inventors may be access to finance for product development. Few investors are keen to provide risk capital for longer-term ventures; the time-scale from idea through prototype development to manufacturable product can prove too long. Until investment is considered to be necessary or profitable, technologies will not be developed. In consequence, potentially new ideas and markets may be ignored, and more generally, the concern with commercial viability may result in the neglect of projects which have high social value potential.

Investment in projects in their early stages of development was seen by the GLEB, as a necessary area to addresss if intervention in the innovation process was to be strategically effective. In this way the GLEB could support selected technologies which were considered appropriate and desirable. The GLEB via the Technology Networks were able to stimulate the development of some selected innovative products by supporting the work of individual inventors, for example, Airlec and Pedelec in the LEEN workshops. This area of innovative activity, product development to prototype, does not incur huge costs so that it was seen as appropriate for assistance given the financial constraints on local authority spending on economic development. However, although products were developed to marketable product stage, industrial partners and private investors were not easy to find for the stage of moving to full-scale production. The GLEB did not have the resources to invest in full-sale production and manufacturing. The original idea was that such products would prove attractive to commercial interests, that is, once developed to manufacturable stage, the product would be taken up by the conventional market mechanism with possibly the original company itself being taken over by a larger one, exactly what happened with the Whitfield Technology Bench, but unfortunately to the detriment of job creation in London.

In addition to the problems of manufacture, there is the problematic nature of the innovation process itself. Innovation is necessarily long-term; in some cases the time-lapse between an invention and its eventual application can be years depending on factors such as market demand and financial investment. The creation of the Technology Networks within the political framework of a local authority meant that the short-term political priorities of demonstrating the effectiveness of the strategy, in practical terms, that is, with actual products, was in conflict with the longer-term process of innovation. Thus in many cases the choice of product development in the Networks was conditioned by what could be produced in the short-term. For example, the energy network; LEEN, in its 'Jobs for Warmth' programme developed a number of short-term innovations that could be balanced by long-term projects such as CHP. This points to the problem of the short time scale of the experiment (Mole and Elliott 1987).

The emphasis on the technical aspects of innovation support led, initially, to a focus on product development. However, the stimulation and development of product innovations has proved to involve a number of problems, and is slow. There was no shortage of ideas, the computer product bank created by ITDG held a list of new product lines but it was not easy to find people to develop the ideas, despite the technical resources of the Network workshops, or to finance the projects. Although the GLEB were able to take up some of the ideas-the time-scales involved in developing a prototype product from an idea were long and in conflict with the aim of immediate job creation.

The commitment of financial resources to product development proved to be a major problem for the Networks. For example, the 'Jobs from Warmth' campaign grew out of the concern about the high cost and poor operation of the heating systems in council owned flats. Technical options were reviewed including the idea of using a medium-sized heat pump to supply district heating networks, CAITS took a leading role in this activity. The plan was to find a local manufacturing enterprise that would expand to produce such units for several housing estates; however the project was halted due to insufficient local council finance. The main point to be gained from this example is that given LEEN 's technical resources, there was no real problem with the technology but rather the problem lay with the political commitment of resources for implementation. The development of socially-useful products involves political processes aimed at the establishment of forms of exchange that are based on social accounting; that is, perceived economic importance is secondary to the fulfilment of a social need. The socially-useful design and development of products in the Technology Networks exemplified the possibility of alternative directions for technological development but was increasingly marginalised as the GLEB faced the realities of the need for commercially-successful products if the aim of employment creation and employment retention were to be realised.

Need-led innovation is thus a political rather than a technological problem. The recognition of this led to the development of the other side of the Network strategy; campaigning for increased public spending to meet local needs. For LEEN this involved energy advice and support work, with an emphasis on relatively simple energy conservation measures. The argument was that jobs could be created more rapidly and needs met more effectively by campaigning for the provision of advice and support on energy efficiency and, where possible, providing help as an exemplar, to reinforce the campaign. In the longer term new products would emerge from this process if they were considered necessary, for example, energy efficiency monitoring equipment. Transnet also adopted this approach with the promotion of a socially-useful transport policy.

This strategy exhibits an approach which is more design-oriented and 'market-led'. Intervention begins with the problem area, and technical needs and solutions are defined more clearly. Working in this way LEEN achieved some success in building alliances wth local community groups and local councils to provide user feedback about needs. The identification of needs and the provision of advice and monitoring services led to the development of a number of new product ideas that were considered for production at the London Production Centre, one of the GLEB Technology Centres, and provided a strong 'lobbying' platform for more resources.

But in general, these attempts to introduce innovation initiatives highlight the problem, not of developing new technologies, but rather of the implementation of technologies that already exist. Production for social needs is apolitical problem because it requires increased public spending in the area of collective service provision; this is effectively limited by the current economic environment. The recognition of this meant looking at the possibility of the development of socially-useful products aimed at individual purchase and consumption via the private market mechanism. One strategy to overcome this problem was to acknowledge the realities of the market mechanism and produce products aimed at individual purchase and consumption, people choose to buy them for their use value. Sharples (1986), posed the dilemma; if products are produced at a price that covers cost then the socal value is not relevant, if it does not then does that mean that the local authority adopts the position of subsidising manufacture and jobs. Clearly, the GLC were not in a position to resource the latter strategy.

An area that was identified as more relevant to the Network approach was the social market. Coleman (1987) clarified LIN's position in an article on investment in the social market. The social market, or areas of collective service provision, could be developed as a potentially profitable market for new products. This market was seen to consist of very specific needs for small volume carefully designed products. A different approach to the social organisation of the innovation process would be required for these products; with the end user closely involved and the market need therefore clearly defined. He argued:

'Getting the product right is the key to marketing socially-useful products, and a design process that brings manufacturer and user together is the best way to ensure that the product is right' (Coleman 1987 p.5).

Whilst the Technology Networks were able to provide the facilities for an alternative social organisation of the innovation process, product development was more dependent on external factors. It was hoped that orders for, for example, aids for the disabled, would be forthcoming via the provisions offered by the Department of Health and Social Security for people with special needs, or via local council purchasing. However the cutbacks in local and national welfare provisions made it much harder to obtain this sort of backing. Nevertheless, the design-led strategy based on the close connection between producers and users could give products the competitive edge they would need to break into these markets.

Of all the Networks established, LIN was the most concerned to address the problems of manufacture, marketing and the commercial viabilty of socially-useful products. This required a re-orientation of their approach because the initial basis for the creation of the networks as facilities for technical support for product development aimed at the public sector led to a lack of attention to the marketing of products. The rhetoric of 'alternatives to the private market mechanism' allowed attention to finance and distribution to be neglected. To an extent this can be accounted for, particularly in the area of marketing, by the difficulty of staff recruitment in an area where there is not a ready pool of people with the right types of skill to achieve a balance between social use characteristics of the product and commercial marketability.

The difficulties of product development encountered in the Networks illustrates how political and economic factors influence the selection and development of technological trajectories: The dominant priorities for investment in R and D, and market demand factors, are likely to preclude the possibility of introducing alternative technical solutions to user problems. For a product idea or invention to become an innovation, technology-push must match with market-pull or be supported by some form of need-pull, for example, government need. Product design occupies a central place in the innovation process, thus the push-me-pull-you relationship between technological capability and the market is central to innovative activity. The commercial viability of socially-useful products remains a problem for the networks, for the nature of the wider competitive market environment constrains the possibility of creating and developing products in an alternative way.

In terms of socially-useful products, the Networks were faced with a daunting task. A task which only the LIN effectively met head on. For the other Networks, the social-use of projects was not narrowly defined to refer to artefacts. The campaigning arm of activities was a strong factor in their approach. For Thames Technet, challenges to existing assumptions about technology and expertise were an important element of their strategy. Finally, for LNTN, the educational side of activities was pursued. These different approaches are discussed more fully in the next section.

7.7 UDAP AND SCEPTRE.

The interesting question which emerges from the policy outcomes is why the policy implementation process emerged in the way that it did. In this section the data collected from UDAP in the West Midlands (see 3.8 and 6.2) and SCEPTRE (see 3.7) is compared with the findings from the Network study. UDAP and SCEPTRE are organisations with similar aims to the Networks. An important difference is the wholly product-focused approach of these organisations. Their experience was qualitatively different to that of the Networks in some areas, and these differences help to make the Networks policy outcomes more understandable. Interviews were carried out with Jim Shutt of SCEPTRE and Bill Brooke of UDAP in 1984.

Both organisations were strongly influenced by the Lucas Plan initiative for socially-useful product development. UDAP was established in 1981 within the Engineering Department of Lanchester Polytechnic in Coventry. As a practical based organisation, it emphasised work on product prototypes by engineering students doing project work as part of their degree courses. The Co-ordinator of SCEPTRE in Sheffield, Jim Shutt, worked at UDAP before moving to Sheffield to establish SCEPTRE. Thus SCEPTRE was strongly influenced by UDAP as a working model. It too emphasised practical product-based activities. For these organisations, user involvement took the form of working with client enterprises on product development. These were enterprises and co-operatives that were referred to the Units by the West Midland County Council and Sheffield City Council. In this way these organisations had closer connections to the local authority. Whilst the Networks were supposed to feed into the GLC and GLEB 'sector strategies', there was a problem with liaison. Sector planning by the GLC failed to provide a direction to the Technology Network activities.

UDAP and SCEPTRE also had a different experience with Polytechnic links. UDAP was supported by Lanchester Polytechnic from the beginning of its existence. Its location within the Engineering Department meant that the maintenance of close working relationships with lecturers and students did not pose too much of a problem. The extension of their activities to include marketing meant forging links with the Business Studies Department in the Polytechnic. This took time to build, the process of 'winning over individuals' was the same that was experienced with the Technology Networks (Interview-Brooke 1984).

In Sheffield, SCEPTRE's links with the Polytechnic were strongly affected by the City Council's links with the Polytechnic. These institutions were close geographically and some Councillors were also on the Board of Governors of the Polytechnic. At the same time, the Polytechnic was keen to respond to the growing local and national pressure to be more community-oriented. Links with SCEPTRE gave the Polytechnic a higher profile in the local community. However, the response from individual departments varied according to the personalities and the politics of the department itself (Interview-Shutt 1984).

For UDAP and SCEPTRE the recruitment of personnel did not present the same problems found by the Technology Networks. The product focus meant that their need was for technically-skilled staff. At SCEPTRE a separate marketing unit was established in the Business Studies and Economics Department. At UDAP Brooke was employed to develop the marketing side of their activities. He felt that the problem with staff recruitment for marketing was because of the orientation of marketing education: degree courses were focused on the marketing operations of large companies, thus a ready pool of appropriately qualified people did not exist (Interview-Brooke 1984).

The employment creation brief for these organisations was also clearer than for the Networks. This was because the Units were responding to demand from local enterprises and co-operatives, via the local authority, for technical and marketing expertise. In this way, the potential manufacturer of the product was already identified. One example, the Advanced Humidifier System developed by SCEPTRE, was the result of a joint venture between the Polytechnic, tenants' organisations and a local co-operative, established by some of the workforce after the closure of a large firm which manufactured machine tools. The local authority housing department, under pressure from tenants to act on problems of condensation in its housing stock, provided an initial market. Here, the local authority acted strategically, in a pump-priming role for the co-operative (Interview-Shutt 1984). SCEPTRE worked closely with the co-operative on product development. UDAP also were concerned to work with enterprises on products, rather than develop products internally, and then find a manufacturer for them.

The Units developed criteria for the assessment of the social-use potential of products. A priority for SCEPTRE was potential employment creation following market research to establish a market need for the product. For employment to result the product needed to be able to compete in the market. For UDAP, the establishment of a need and a market for products was the primary focus. A working definition of socially-useful was non-existent, therefore, they found it easier to identify what was not socially-useful. A more useful approach to social-use was 'is the product wanted' (Interview-Brooke 1984). Thus UDAP and SCEPTRE established a pragmatic approach to socially-useful product development.

- An approach mirrored by LEEN and LIN in London.

The product-based nature of UDAP and SCEPTRE, together with the stronger liaison with the local authority and stronger links with the Polytechnics, meant that these institutions were not faced with building their own constituencies in the same way as the Networks were. They acted primarily as technical and business resource centres. The product base also meant that these Units were more geared to the problems of manufacture and markets from the outset of their operations. The role of the local authority as purchaser of some goods exemplified the potential of the public sector market for this approach. This was particularly evident in Sheffeld, which benefited from a more homogeneous political culture than either London or the West Midlands.

Why were the experiences of UDAP and SCEPTRE qualitatively different from the Technology Networks? The product focus has already been mentioned. Another area was the lack of emphasis on user involvement: UDAP and SCEPTRE worked with client enterprises and concentrated efforts more on student projects. The Networks had to adopt a pro-active approach to participation, and the difficulties of liaison with the GLEB and the Popular Planning Unit at the GLC compounded the problem of building a cohesive political base. The geographical nature of the London area also meant that the Networks did not benefit from linkages based on close proximity to neighbouring institutions, like the GLEB and the GLC. The technology-based and area-based brief for the Technology Networks meant that their activities were potentially more focused on specific issues, the problem was to create a specific market for them. In addition, the political elements of a socially-useful technology policy were more central to their approach.

7.8 OTHER ALTERNATIVE INITIATIVES.

In this section the Science Shop experiment in France, the West German experience of socially-useful production and the Utopia Project in Scandinavia are discussed. These alternative initiatives highlight some of the findings of the Network study. Of particular importance, it draws attention to the fact that the policy initiative by the GLC/GLEB for socially-useful product development, was affected by the wider social and cultural patterns of technological change in society. A point emphasised by Thames Technet.

The problems that have been encountered in experiments designed to link academic institutions with the community have to some extent been shared by the Science Shop movement in France. The aims of these institutions were:

'to provide a means for members of the public to seek answers to scientific and technical questions arising from their daily lives, and for scientists and engineers to apply their knowledge, training and skills to topics of social concern' (Science 1984).

The problems which emerged from these experiments are documented in an article by John Stewart (1988) who was involved in the Science Shop movement in France. He argued that the premise on which Science Shops were based, that is, to provide answers to questions posed by the public, was not straightforward. The process of the translation of a 'lay' question into scientific terms posed problems, often due to the inability of the client to know what to ask and what science had to offer. In addition, the interdisciplinary nature of many problems required the breakdown of barriers between scientists, technologists and lay persons. There was always the danger of a 'technical fix' attitude to social problems. In terms of community participation, Stewart described the problems:

'More damaging, I feel, was the lack of support for the Science Shop idea from the public in general and our 'clients' in particular. Meetings of the Science Shop collective were open to all and were generally held out of work hours, but apart from a short period in the wake of the initial enthusiasm, attendance by non-scientists was quite exceptional. Worse, clients were usually not even interested in the treatment of their own cases' (Stewart 1988 p.60).

The difficulties of community participation experienced by the Networks was shared by the Science Shops in France. The lack of knowledge about scientific and technical expertise among lay persons was an important point made by Stewart. This resulted in an inability to recognise what the Science Shops had to offer. An attitude which would make these organisations appear largely irrelevant to everyday experiences of technology. Linn (1988) made this observation in relation to the Technology Networks, she argued that they were culturally unfamiliar institutions, so that the difficulties of community participation in their activities was not suprising. The recognition of this supports the argument that for a socially-useful technology policy to be of benefit the political, social and cultural experience of technology are areas that need to be addressed.

In West Germany, some attempt has been made to address the cultural and political aspects of socially-useful production. This has concentrated on marketing and retailing rather than product development. Experiments like Mehringhof (Carter 1985) are geared toward alternative marketing initiatives whereby socially-useful products, such as Nicaraguan coffee, are aimed at a politically-conscious market segment. Carter (1985) states:

'more than price, it is political sympathies which determine consumer choice on this alternative market'.

This suggests that attention to publicity, marketing and the distribution of products by the Networks at an earlier stage of their development may have given them a higher profile in the community, thereby easing the problems of participation. The campaigning activities of LEEN and Transnet reflected this approach. For example, much of LEEN's work was aimed at 'marketing' socially-useful information on energy-related issues.

An important finding from the Network study was the variety of activities that could be encompassed by the concept of user involvement. Product design and development remained the preserve of technically skilled people. Whilst this may not be suprising, it does have important implications for the ability of lay-persons to articulate their needs for alternative products. User involvement in product design and development was found to be very dependent on 'hands-on' use of technical equipment within a specific political context in the Lucas experience (see 5.4) and also in a Scandinavian initiative; the Utopia Project. Discussion of these initiatives indicates that the concept of user involvement in actual product design was not easily transferable to a community context advocated in the Network idea. For the Lucas workers 'social-use' gave the rallying cry to their campaign. Product development was built on the specific skills of the workforce and on the technical resources available within Lucas Industries. Within the Utopia Project (Howard 1985) efforts to develop new technology grew out of a dissatisfaction among trade unionists with the limitations on skill development and work organisation embedded in text and image processing technology (the social relations of technological development were discussed in Chapter Two).

The Utopia Project involved a homogeneous group of skilled workers belonging to the Nordic Graphics Workers' Union, and computer and social scientists from research institutions in Sweden and Denmark. The group developed a participative and skill-based design method for product development. Information on printing activities and work organisation was gathered at the local level. Social values, such as, skill, quality of work organisation and quality of product were then translated into computer hardware and software for the printing industry.

Throughout the project, a process of 'design by doing' was emphasised. It was found that the best method for discovering print workers' demands for new technology was by giving them direct access to its use. A computer workstation programmed with a few sample lay-out functions allowed participants to refine their ideas and needs for alternative specifications for the hardware, software and for work organisation (Howard 1985).

The Utopia Project was an attempt by workers to design their own text and image processing technology. However, despite the high degree of user involvement in the project, the problem of the manufacture and the market for the technology remained. To get the technology into manufacture it was necessary to compromise on some of the design specifications. The Utopia recommendations for user-friendly software were incorporated into the system by the manufacturer. The ideas concerning work organisation and training were dependent on negotiations between employers and unions.

The initiatives which have displayed a high degree of user involvement in product design and development have involved skilled workers in a specific locality around a specific issue. The Technology Network approach to user involvement underestimated the importance of, first, 'design by doing' for the articulation of need for product development. Second, the technical skill required in order to know what technology can do and how it can be relevant to social needs.

7.9 CONCLUSION.

The analysis of the Technology Network approach has indicated that there were certain problems with the basic premises on which the policy was based.

User involvement in the selection, design specifications and development of products, together with access to technical resources were not found to be the main elements for a socially-useful technology policy based in the context of a local authority.

The policy formation, which drew in large part from the Lucas Plan initiative, did not take into account the qualitatively different context in which the Technology Networks were located. Before the practical elements of the strategy could be developed it was necessary to build an appropriate political base for the initiative. Clearly, the commitment of resources to this side of activities entailed more political risk than the commitment of resources to the development of products. At this point, however, the policy began to fall between two stools. If user involvement, the articulation of needs and a close relationship between user and producer were to be achieved then substantial work on the political side of the approach was necessary.

Otherwise, the wholly product-based practical element of the strategy was in danger of reflecting the needs of the Networks for actual products, coupled with the problems of manufacture and markets which that involved. The element of user involvement which distinguished this socially-useful approach to technology policy from other more traditional methods of product development was in danger of being marginalised. The notion of an alternative approach to innovation remaining mere political rhetoric.

This was the dilemma faced by the Networks - how was it possible to move from a political exercise to the presentation of real economic and technological alternatives. The intuitive appeal of the idea of a socially-useful technology policy is strong but the question remains of whether policy initiatives were based on social, economic and technological realities. Certainly, the idea of user involvement in product design and development, and technology transfer of socially-useful products to local enterprises was ill-conceived. The economic environment limits the potential for the production of alternative technologies in alternative ways. The Technology Network initiative demonstrated the power of market forces for innovative activity. It drew attention to the need to address the relationship between purchasing power and social needs. Further, it demonstrated how the national economic and political context affects the position of the local authority as an agent of technological change.

What did emerge from the Technology Network initiative were elements of a pre-figurative strategy for technological development and change. The study indicated the possibilities of varying models of a socially-useful technology policy: community-based, campaign-based and practical product-based approaches. The key areas for a local authority attempting to develop a genuinely participative approach to technological innovation have been identified. First, information about alternative technologies, what technologies can and cannot do, are important to initiatives designed to affect the future direction of technological change. Second, access to technical facilities and training are important prerequisites to participation in the innovation process. It is only by working with products that the ability to generate and articulate needs for alternative product development can be realised. Third, whilst the remoteness of technology from everyday life, and the contradictions inherent in technological development continue to appear as practical problems, then the political and cultural issues of technological change will remain obscured. A change of product within an unchanged technological environment cannot be the basis of a socially-useful technology policy.

CHAPTER EIGHT: THEORETICAL IMPLICATIONS AND CONCERNS.

8.1 INTRODUCTION.

The research has focused on the role of technological innovation in a process of social and political change envisaged by the left-wing Greater London Council when it took office in 1981. The Technology Networks study showed how issues of the control, development and the social shaping of technology were addressed at the local level. At this point in the discussion the aim is to address the central question (see Chapter Four) raised by the Lucas Plan initiative and taken up by the GLC, of why certain technologies are developed whilst others are not even though there may be a social need for them.

The findings from the Technology Network study revealed two major insights into this important question. First, the innovation process is a political, as well as a practical activity. The allocation of resources to socially-useful product development, the articulation of social needs, attention to demand factors within social markets all involve political processes. Without a match between these factors and the supply-side elements embodied in the Networks then the practical aims of product development and manufacture incur problems. Second, the realities of our technological environment diminish the possibilities for a genuinely participative approach to innovation. The facilities for a 'popular' social organisation of the innovation process remain under-utilised without the support of education and training programmes, campaign work, and the promotion of discussion and awareness of technology issues; all key components of an 'alternative' technological culture or paradigm.

In Chapter One the concept of technological paradigm (Dosi 1982) was used to explain the emergence of dominant routes of technological development. Specific areas of high-technology, and its attendant association, in ideological terms with technological progressiveness, serve to exclude and limit technological development in areas considered 'alternative'. Powerful economic, political and institutional factors shape technological development. This challenges the idea of a technological determinism and illustrates the political nature of innovative activity. In addition, it suggests that there is a direct relationship between local authority technology policy and questions of innovation and power - not the least in the most effective exercise of power, the prevention of the very existence, articulation or consideration of alternatives (Lukes 1974, MacKenzie 1987).

Noble (1983) argues that the question of power is not an economic or technical problem but rather a political and social one. The political commitment to change does not necessarily lead to change, the missing ingredient is power. And indeed local authority power is limited. But does this provide an adequate explanation as to why alternative strategies for technology remain only rhetorical and experimental? The unequal distribution of economic and political power in society may be an intuitively appealing explanation, but it requires further examination. There is a need to clarify the relationship between power in society and alternative technological development, otherwise this explanation can only lead to an impasse in informing practical action for technological change (Bruce and Mole 1987). The tendency is to get stuck in the circular argument that the ability to shape technology is power-dependent (see Chapter One) and so changing society is necessary to change technology; but society cannot be changed without changes in technology (see Chapter Two).

In this chapter the question of why certain technologies are developed whilst others are not is raised in an attempt to understand and unravel the relationship between technology and power in society. In 8.2 attention is paid to the external constraints on local authority policy discussed in Chapter Three. The aim is to understand how this affected its potential as an agent of technological change. In 8.3 the theoretical insights into the innovation process discussed in Chapter One are related to the GLC initiative. In 8.4 the insights into the social construction of technology discussed in Chapter Two are considered in an attempt to assess their practical use. In 8.5 some conclusions are made. If the relationship between technology and power in society can be made more understandable, then points of intervention in the innovation process can be identified, which have specific relevance to the role of a local authority in technology policy.

8.2 THE LOCAL AUTHORITY AS AN AGENT OF TECHNOLOGICAL CHANGE.

The socially-useful technology policy formulated by the GLC was a political programme dependent on national level re-allocation of resources to public sector service provision. A programme that was in stark contrast with the major priorities of the Thatcher Government during the 1980s; the control of public spending and the concern to replace municipal provision with market provision (Young 1986). Attempts to control public spending by the central Conservative Government led to a series of legislative changes, including rate-capping, and finally the abolition of the GLC itself, along with the other metropolitan authorities in 1986 (see 3.9). Financial curbs and legislative changes were envisaged as the route to a more limited role for local government - a role which explicitly ruled out redistributive policies at the local level (Bramley 1984).

Conversely, the Labour Left saw the GLC as an arena of socialist advance. As a radical Labour Left administration, the GLC were keen to present a socialist alternative to Thatcherism and the free market economy. To be achieved by a demonstration of the importance of public sector institutions at the local level, to the economy as a whole (see 3.5). Thus, the technology and the economic policies of the radical councils need to be seen against a background of increasing change and tension between the centre and the locality.

In the face of opposition from the centre, the local authority possesses only limited economic and political power (see 3.2). Indeed the discussion of local authority initiatives (see 3.10) suggested that they do not have the resources to effectively intervene in the local economy. Rather their strength lies in their role as employers, purchasers and providers of goods (Boddy 1984, Bennington 1985). It would be easy to conclude that the GLC demonstrated, in embryo, what may be possible within a socialist society, but that they were constrained economically and politically by the Thatcher Government. Whilst this is evidently the case, particularly in relation to funding pressures on the initiatives, is this the whole story? How would the policies have fared if there had been national support? This can only be open to conjecture, but here the benefit of historical hindsight does exist. The Labour Party 1986 Charter for Local Enterprise (NEC 1986) (see 5.2) included proposals for a national network of Local Enterprise Boards. However, the issues of political constraint are also likely to be faced by Labour Party initiatives at the national-level. One major example was the 1974 Labour Programme for Industry and the National Enterprise Board. The left-wing of the Labour Party prescribed a democratic base for industrial policy which included a National Enterprise Board with substantial powers, planning agreements and increased industrial democracy. The difficulties of implementation of the strategy were discussed in 5.3. The likelihood is that a national initiative by the Labour Party would meet the same type of political and economic opposition in the 1980s.

As an agent of technological change the very nature of local government, in the national context of the 1980s, limits its potential. Even with national support by a Labour Government, political and economic constraints persist. Not the least, in the fact that much of British industry is foreign-owned (Guardian 4.8.88). The discussions in Chapters Five and Seven indicate the difficulties with the approach. It could be argued that the policy itself was based on an idealised view of the local economy and manufacturing industry. As an economic strategy, innovation is based on the development of quality products at an appropriate price (see 8.3). Given the absence of national support for the socially-useful elements of the policy, what was primarily a political programme became an ill-fated economic strategy operating within the competitive market system.

The alternative economic and technological policies of the GLC were constrained politically and economically. They were also constrained culturally. The GLC policy formation drew on the Labour Party Programme of 1974 and was influenced extensively by worker and community planning initiatives, of which the Lucas Plan represented a particular exemplar (see Chapter Five). However, the 'popular' approach may be seen as contradictory to the individualistic 'enterprise' culture of the 1980s. Within this context, participation in economic planning and alternative technology initiatives is culturally unfamiliar (see Linn 1988).

The perspective of pre-figurative politics played a large role in the GLC strategy (see 5.2). It was pre-figurative in that some elements of the strategy were not expected to be effective in their own terms but to pre-figure some future goal or socialist solution. The Network study indicated the political and practical factors that need to be addressed if a local authority were to develop a role as an agent of technological change. Socially-useful product development and a close relationship between technology and social need ought to be a participatory, on-going activity. However, what exists is a technological environment that is increasingly specialised and privatised. For a local authority to begin to develop a role in technological change, then practical product development requires education and training facilities - an area where the local authority can exert an influence.

8.3 THE INNOVATION PROCESS.

The GLC policy found itself unable to match technology-push with demand-pull, the key elements for commercially successful innovative activity (Freeman 1982). In the previous section it was argued that political and economic factors in the national context constrained the development of an alternative technology policy by the GLC. The problems of manufacture and markets which emerged in the case-study pointed to the power inherent in existing political and economic institutions to direct the innovation process. This supports the argument put forward in Chapter One that powerful economic and institutional factors channel the direction of innovative activity and technological change, for example, through the allocation of resources to research and development in certain areas and not others, and the conservatism of economic institutions in their support of 'alternative' technologies. The question which emerges is how these powerful elements become embodied within the innovation process so that the dominant technological paradigm becomes difficult to resist.

In Chapter One, the theoretical concern to explain innovative activity was considered from an economic perspective. The concepts of 'technology-push' and 'demand-pull' discussed referred to the crucial factors for successful innovative activity. Technical change comprises a series of innovative steps arising from indicators signalled through the interaction between market needs and technical possibility. Successful innovations were those that matched technology with the market, consumer/user requirements were understood and adequate resources were available for R and D and the launch of innovations. For the GLC strategy the emphasis on production (see 5.1) meant that the strategy was essentially supply-side or technology-push. The ability of a local authority to influence the market and the economic environment was seen as minimal. Robin Murray (1985), the Chief Economic Adviser to the GLC acknowledged this limitation when he wrote:

'In intervening in the market economy, what we aim to do is to strengthen the socially-useful forces, however bound they may finally be by the conditions of profitability. That is why we speak of operating in and against the market'.

Thus, the appropriate and only feasible option for local authorities as agents of technological change was to challenge the market from within. The effectiveness of social needs as the basis for the stimulation of innovative activity was found to be marginal in a competitive market economy. The GLEB were unable to influence demand factors from the public sector so that the mechanism did not exist whereby minority interests without economic and political resources could influence the innovation process. The reliance on technology-push factors in the form of the creation of the Technology Networks underestimated the significance of demand factors for the successful implementation of the strategy, crucial for an invention to become an innovation. Demand factors include the articulation of social needs, markets and opportunities for manufacture. The latter being dependent on the existence of adequate demand.

The Network study demonstrated the power of market forces for innovative activity. The lack of public sector or social markets was matched by the lack of a mechanism whereby purchasing power was directly related to social need. A major finding of the study was that if technology and need were to be more directly related, then the relation between purchasing power and needs must be addressed. The importance of demand factors in the form of Government support for the initiative was exemplified by the finding that there was not a problem with the technology but rather with the commitment of resouces for implementation (see 6.3).

Need-led innovation, therefore, was found to be a political problem which required the articulation of social needs and popular demand for a re-allocation of resources at the national level. This supports Noble's (1983) contention that the problem of power in relation to technological alternatives is not an economic or technical one but a political and social one. If the political commitment to alternative technologies existed at the national, and international level, then the economic commitment to the development of these technologies would follow. However, this commitment did not exist, and we are led back to the problem of power.

An understanding of the specific events within the innovation process raises the problem of power, but also indicates areas of possible intervention. The discussion of how innovation occurs presented in Chapter One centred on the events within the innovation process between the recognition of demand by producers and the end-result; the appearance of a new product.

Demand-pull theories point to the recognition of a need as the main stimulus to innovation but as the critique indicated the existence of social needs does not necessarily lead to their satisfaction (see 1.10). Market needs are economically-backed demands, therefore are significant in a competitive market system. Their economic significance comprises the connection between technological innovation and the market.

A problem voiced by Mowery and Rosenberg (1979) (see 1.5), especially in relation to radical innovations was that potential needs and demands are limitless and could refer to almost anything. Thus it is difficult to conceive of how these potential needs and demands trigger innovative activity at a given point in time. The supply of ideas depends on the state of knowledge at particular moments in time and ideas may not correspond with needs (Bruce 1984). The mechanism by which manufacturers and needs are drawn together is the market mechanism. Although markets are no more than mechanisms for selecting between products and methods of production, and are not systems of production in themselves, they embody powerful cultural assumptions. The market is a culturally and socially-conditioned milieu which reflects the dominant cultural bias toward 'progressiveness' and technological sophistication (see 1.9). For example, it is easier to locate, and less expensive to buy a microwave oven than a fossil fuelled oven or Raeburn.

In addition, there is the problem raised by Dosi (1982), and which the Networks were faced with in terms of socially-useful products - how to express a need for a product that does not already exist. This involves a creative leap that is beyond the ability of most lay-persons (Dosi 1982). As an aside, this point also captures the important truth that products get made in the first instance as a result of designers and producers creative ideas about what people need and want. Innovative activity that does not have a direct relationship with the market remains difficult to explain. The market not only presents the range of goods on offer, but this range of goods is necessary to further product development. It is through the identification of the inadequacy of a particular artifact to fulfill a particular need which stimulates re-innovation or the re-adaptation of products. Thus product development is often an incremental process. Demand factors cannot affect a technology until it has been invented, but then become crucial to innovation. New innovations may be stimulated by the users perception of the inadequaces of the existing technical solution on offer. Ray (1985) developed criteria for successful innovative activity. He argued that new innovations need to complement surrounding technologies, correspond with user needs, have some advantage over competing technologies and be offered at an appropriate price. This presents problems for alternative technologies because if the range on offer is unable to reach the market, it becomes problematical to conceive how it is possible to stimulate demand and further product development for these technologies.

In terms of alternative technologies needs are meaningful when there is some form of concrete possibility of realisation, thus needs are related to the choices on offer. This raises the question of how is it possible to secure the articulation of need without a range of choices being already available? What are the mechanisms for offering alternative technological solutions to problems? Once alternative technologies are developed, how is it possible to offer these to groups who do not have the economic respurces to pay for them? All of these problems were faced by the Networks and represent crucial issues for an initiative which attempts to strengthen the socially-useful forces from within the marketplace.

Ray's (1985) criteria, mentioned above, is particularly telling in the notion that new innovations must complement existing technologies. The evolutionary nature of much technological activity (see 1.6) suggests a process of technological convergence. Firms exhibit a trajectory of product development which is closely tied to economically-defined needs-expressed through the market. The selection of goods on offer tends to fall into similar trajectories of development as companies seek to imitate market leaders. Technology builds on technology in an incremental process, thus product design, re-design and re-adaptation comprise a large part of innovative activity once a trajectory has been developed. Once the technological capability exists then demand has an 'inducement' effect on surrounding technologies and technological systems (Hughes 1983, Rosenberg 1976). The strong cultural bias within the marketplace effects technology at the level of the firm. Coombs et al. (1987) note that each firm will not only adopt technological solutions and approaches which are going to remain stable for short periods of time, but which are also similar to those adopted by other firms operating in the same technology. Thus technological trajectories (Nelson and Winter 1977) become common to most firms operating within an industrial sector. The notion of dominant design (Abernathy and Utterback 1975) also supports the argument for a technological convergence. The implication is that enterprises are constrained in the technological options open to them. The aim of maximising profits tends to produce certain relatively stable lines of development. New technological regimes and trajectories emerge from threats and opportunities for competitiveness within the marketplace. The important point to note is that this is an on-going and dynamic process, open to change, but change within a 'cultural brief' and outlook or dominant technological paradigm (Dosi 1982).

In Chapter One it was argued that support for science and technology was planned and controlled through research funding, the result of decision-making at the earliest stages of technological development (see 1.8). It was argued that this decision-making was based on the criteria of economic growth and ideological and prestige factors. This 'cultural brief' excludes alternative routes of development. Thus the dominant technological paradigm becomes difficult to shift. For alternative initiatives points of intervention need to be identified within the dominant technological paradigm. Areas which can build on existing technology and information so that users and consumers can begin to exert some influence on the future array of technologies on offer in the marketplace. What is implied is that this is an incremental process that is not necessarily achieved by an over-emphasis on products or the practical arm of innovative activity. Of equal importance is the presentation of a political and social challenge to conventional approaches and beliefs about both innovation and the role of the market in matching technology to needs. The political commitment to addressing issues of technological change by the GLC led to a short-lived alternative strategy for technology. In the final analysis, the experimental project in product design and development met the realities of innovative activity in a competitive market economy. The Network study findings indicated that an approach which began to address the issues of the unequal distribution of technical skill, technical information and the social organisation of the innovation process was a means of re-introducing some elements of power into user and consumer choice.

8.4 THE SOCIAL ORGANISATION OF THE INNOVATION PROCESS.

The socially-useful technology policy developed by the GLC appeared to present the possibility of relating technology directly to social need through product design and development. The exemplary nature of this activity could then be used to demonstrate an alternative and pre-figurative paradigm for technology in society. The policy initiative was based on a critique of the neutrality of science and technology. Technology was found to be inherently political; designed to open certain options and close others (Winner 1979). Technologies embodied the social relations of their design and development (see 2.5). The sociological argument presented in Chapter Two yielded the proposition that technology is potentially multi-directional. Design lies between technology-push and market-pull (Walker 1986). Design plays a central role in the innovation process. The technical solutions that emerge in relation to user problems exhibit a number of potential design configurations that are dependent on the priority given to certain criteria, for example, different designs which emerge if priority is given to cost or alternatively to materials. This suggests a possibility exists to influence product design and the direction of technological change. The practical application of this insight by the GLC in their technology policy met the problem of power in society (see 8.3).

The micro-level studies (see 2.4) of technological development introduced the concepts of 'actors' (Callon 1980) and 'social groups' (Pinch and Bijker 1984). It was argued that technical development is potentially multi-directional, and that the end-product; the technological artefact embodies the compromises between powerful interest groups able to influence technology at an early stage of its development. However, the concentration on product development processes does not address the issues of power. For example, the exclusion of certain groups from the decision-making process (Russell and Williams 1987), the setting of technological agendas (MacKenzie 1987, Lukes 1974), the understanding of the political and economic context of the initiative, that is, how is the stage set to suggest the solution to the problem of technology. The nature of the local authority, and the analysis of local economic development by the GLC was the setting within which the Networks were based. All of these factors need to be taken into account so that the specific constraints and possibilities for change at different levels are recognised. To influence the innovation process at the national level was precluded for the initiative, but within certain constraints some ability was found by the Networks to begin to influence the innovation process at the local level.

Sociological arguments question the immanent logic of technological development. The dominant technological paradigms are not fixed, rather they act as a resource to be used (MacKenzie and Wajcman (1985). The question which emerges is how to gain practical access to that resource. The findings from the Network study suggest the importance of recognising how innovation occurs, and within that to develop facilities for an alternative social organisation of the innovation process which uses information, hands-on use of technical equipment, education and training to lay the base for people to begin to think of alternative designs for products and processes. The ability to develop alternative technologies requires an understanding of existing technological development. This means addressing the wider context of technology in society. Not only the context of product design and development but the context of use and implementation of the technology. In addition, the environment in which technologies operate and the social and cultural assumptions and implications which surround technological development. This involves a recognition of technology as a social and cultural activity. Otherwise the spectrum of user involvement in product development involves only a change of procedure within an unchanged balance of power. As such it is unlikely to influence technological development.

The Networks study found that a socially-useful technology policy needed to be seen as a cultural and social policy. It was not enough to concentrate only on product development. The separation of technological practice from its social context leads to a narrow definition of technological development as new or improved products. This reflects the economic perspective of the innovation process defined as the process by which new products are conceived, developed and launched (Roy 1986). Concentration on this aspect of technological development obscures the importance of how technology operates in the real world. The world of an unequal distribution of power and resources in society. The ability of the Networks to encourage the participation of users into a process of technological discussion around existing product development comprises the basis of a participative approach to the innovation process.

8.5 CONCLUSIONS.

The question of why certain technologies are developed whilst others are not even though there may be a need for them is directly related to political processes and issues of power in society. The nature of the relationship between power and technology raises certain issues about the innovation process and the existence of technological alternatives. The specialised and increasingly privatised nature of the innovation process in competitive market economies precludes access to information about technological developments. The unequal distribution of decision-making at the very earliest stages of technological development ensures a differential access to the product design and development process. The deference to scientific and technical expertise, the exclusive nature of technical skill, and the realities of the social relations of class, gender and race in everyday life all diminish the possibilities for a genuinely participative approach to innovation. The argument that the ability to shape technology is power-dependent, so that social and political change is a pre-requisite to influencing the direction of technological change is important for the success of alternative initiatives for technology. However, the nature of our technological environment itself embodies social and political relations thus change in society requires change in technology also. This suggests a two-pronged approach to technology which incorporates political and practical elements within a strategy. For a local authority the ability to affect technological development at the national level is minimal. In addition, its ability to affect innovative activities within local manufacturing industries is constrained. Given these constraints the possibility of practical action appears overly problematic. However, this discussion has identified certain areas, specifically education, training and access to information, that are possible for a local authority to address.

CHAPTER NINE: CONCLUSIONS.

9.1 INTRODUCTION.

The discussion of the Technology Network initiative ended with a rather pessimistic view of the role of a local authority as an agent of technological change. To conclude on this note would be to uphold a technological determinist position; the immanent logic of technological development remains somehow autonomous and outside of societal control. Technological determinism presents the technology selection process as 'objective' and neutral, rather than political and always the result of decision-making at the very earliest stages of technological development. The literature surveyed in Chapters One and Two and the events that surrounded the GLC technology initiative show quite clearly the complex interrelationships between technology and society. The conclusions of the research suggest that a socially-directed technology policy needs to address the social organisation of the innovation process, the content of the technology itself and the political and cultural beliefs and attitudes about the role of technology in society.

Theoretically innovations are influenced by user needs and economic demand, but also may be 'induced' by a variety of economic, social and political factors. The GLC attempted to base a technology policy on social and political processes. The exploration of the issues raised by the Network study indicates some avenues that a local authority could effectively begin to pursue in order to intervene in the innovation process. The conclusions of the study and the end-result of the research, suggest certain priorities for resource allocation by local authorities concerned to achieve socially-directed technology policy objectives.

9.2 CONCLUSIONS.

1. The radical policy initiatives represented a creative departure from traditional assumptions about the role of the local authority in economic and technological development. In relation to technology, two main points may be made. First, the local authority is in a good position to recognise unmet needs, often their collective provision is included in their statutory duties, for example, heating needs of council tenants, aids for the disabled and so on. Second, the recognition of the unequal distribution of decision-making at the very earliest stages of technological development which ensures a differential access to the product design and development process was seen as an

important area to address.

The attempt to influence the social organisation of the innovation process and to embody socially-useful choices into product design with the establishment of the Technology Networks raises important questions for technology policy. It draws attention to the need to discuss and integrate the potential social impacts of technological development into the design stage of technology policy. And, in this way to ensure that the gap between technological innovation and the implementation and use of technologies within their social context is recognised and addressed during the formulation stage of a technology policy.

2. The deference to scientific and technical expertise, the exclusive nature of technical skill, and the realities of the social relations of class, gender and race in everyday life all diminish the possibilities for a genuinely participative approach to innovation. This suggests the need for a two-pronged approach to technology issues which incorporates political and practical elements within a strategy. The concentration upon practical technological activity is a key area for the development of alternative technologies. But practical activity requires a context within on-going political processes. Training programmes in technological awareness and the creation of facilities for

working with technology and generating alternative solutions; 'design by doing', is an area that can be addressed by local authorities and one which would benefit from additional resource allocation. The Technology Networks were a good example of the potential for this approach. Findings from the research indicated a clear need to support both practical training and the more general process of creating space for discussion around technology issues. Whether practical awareness or conceptual/social understanding of the issues is the necessary pre-requisite to a socially-directed technology policy is debateable. But it is a debate that requires an on-going commitment to the integration of both political and practical activities. Socially-directed innovation requires a hegemonic strategy that influences attitudes to technology, and promotes a popular technological awareness. Practical exemplary projects have a role as a focus for political mobilisation. The coupling of technology with effective demand is crucial, in this case effective demand is political power (Mole and Elliott 1987).

3. The Technology Network initiative raised the question of user involvement in product design and development. A lack of clarity surrounds this concept, exemplified by the variety of forms which emerged from the process of encouraging participation in the Networks. The management

of user involvement emerges as an issue for investigation. For example, how is it possible to manage a transfer of power from the expert to the lay-person, crucial if participation is to be achieved. The Technology Networks underestimated the importance of design by doing, the distribution of technical skill and the ability of non-designers to generate new possibilities. The nature of technological skill and design expertise means that not all users would be capable of design work. The end-result of a lack of clear thinking about the role of the user in the innovation process is user activity which tends to be ad hoc.

In general, the role of the user in the innovation process is non-existent. A further difficulty is a lack of knowledge about scientific and technical expertise. Therefore certain training activities, information and access to technical resources are necessary as a basis from which to draw on user potential. For a local authority attempting an initiative based on user involvement what is required is some evaluation of the form of user involvement necessary to a socially-directed innovation process. Here the cultural approach to technology issues is important if allied to a political framework. The danger is to look to users as the lynch-pin to alternative technological activity. Users are as stuck as everyone else when it comes to the identification of needs for alternatives, needs are related to existing goods on offer. The recognition of a need tends to be an incremental process based in the dominant technological culture. Needs become meaningful when there is some concrete possibility of their realisation, that is, they are firmly related to the choices on offer. The articulation of future needs requires a qualitatively different approach than commenting on the inadequacies or otherwise of existing product design. What is required is a creative leap of the imagination, which is not everyone's forte. Therefore, points of intervention need to be identified within the dominant technological paradigm, for example, using information on existing technologies as the base from which to begin to exert some influence on the future array of goods in the marketplace. This incremental process is not necessarily achieved by an overemphasis on product development. The emphasis on campaigning which emerged from the Network study indicates that this is an area where the local authority can exert an influence.

4. The Technology Networks created the facilities for an alternative organisation of the innovation process, product development was more dependent on external factors. The social organisation of the innovation process around the concept of social-use drew attention to its political elements which include education and training, campaigning

and hands-on use of technological equipment. Technology is social, thus a programme for alternative products needs to institute a programme of social change. For a local authority priorities for resource allocation should focus on design and technology education which raises the issues of what does a social technology look like, what does a feminist technology look like and so on. Technological discussion as an on-going practical activity could then form the base of a popular alternative technological hegemony, crucial to political demand for technological change.

9.3 AREAS FOR FURTHER RESEARCH.

The policy outcomes discussed in Chapter Seven are the key to the needs of future research. Three main areas emerge. First, technology and culture issues. Second, practical product development issues, and third, comparative analysis of local authority developments in technology policy.

The social shaping of technology literature reviewed in Chapter Two yields a fuller understanding of the relationship between technology and society with its focus on the content of technology itself. An area which had been neglected until comparatively recently. This research has benefited from these theoretical developments because they drew attention to the importance of addressing the content of technology issues and the social relations of the innovation process. Equally, however, the research has drawn attention to the lack of information about the nature of popular technological culture, crucial to initiatives designed to encourage user involvement in the innovation process. What is required is further research into conceptions of technology in the context of the user, to include images of technology, users opinions of product design and investigation into beliefs surrounding the possibility of alternative technological solutions to problems and the ability of users to influence technological change.

On a more practical product development level, managerial and social marketing issues are important areas to address if a more strategic analysis and theoretical framework for the effective management of alternative product development is to emerge. The management of innovation literature related to alternative technological developments may yield important insights.

Local authority developments in technology policy remains an interesting area. Both UDAP in Coventry and SCEPTRE in Sheffield still exist, and the majority of local authorities are now involved in product innovation issues via Science Parks, Innovation Centres and so on. The influence of the GLC approach on these initiatives, and comparisons between technology strategies developed by qualitatively different agencies situated at either end of the political spectrum would be important to any further analysis on the role of the local authority as an agent of technological change.

APPENDICES.

APPENDIX ONE.

Interview Schedule.

1.Name of Respondent.

2.Position.

3.Gender.

4.Age.

5.Background Experience.

6.User Involvement.

a) how was this defined?

b) who was involved in project/product design and development?

c) what participatory techniques were employed by the Network?

d) in what form were user needs incorporated into product design/development?

e) how were user needs articulated?

f) what were the main problems encountered in the encouragement of user involvement?

7. Access to technical resources.

a) how were these defined?

b) what facilities did this involve?

c) how was access negotiated for users?

d) what were the links between the Network and Polytechnics, how did they emerge?

e) how necessary was this link for technology transfer from the Polytechnics to the community?

f) what were the main problems encountered?

8. Social-use.

a) how was this defined?

b) how were projects assessed in terms of this definition?

c) where did project/product ideas originate?

d) how did the project/product relate to need?

e) how were needs articulated and identified, and by whom?

f) who was involved in product design/development?

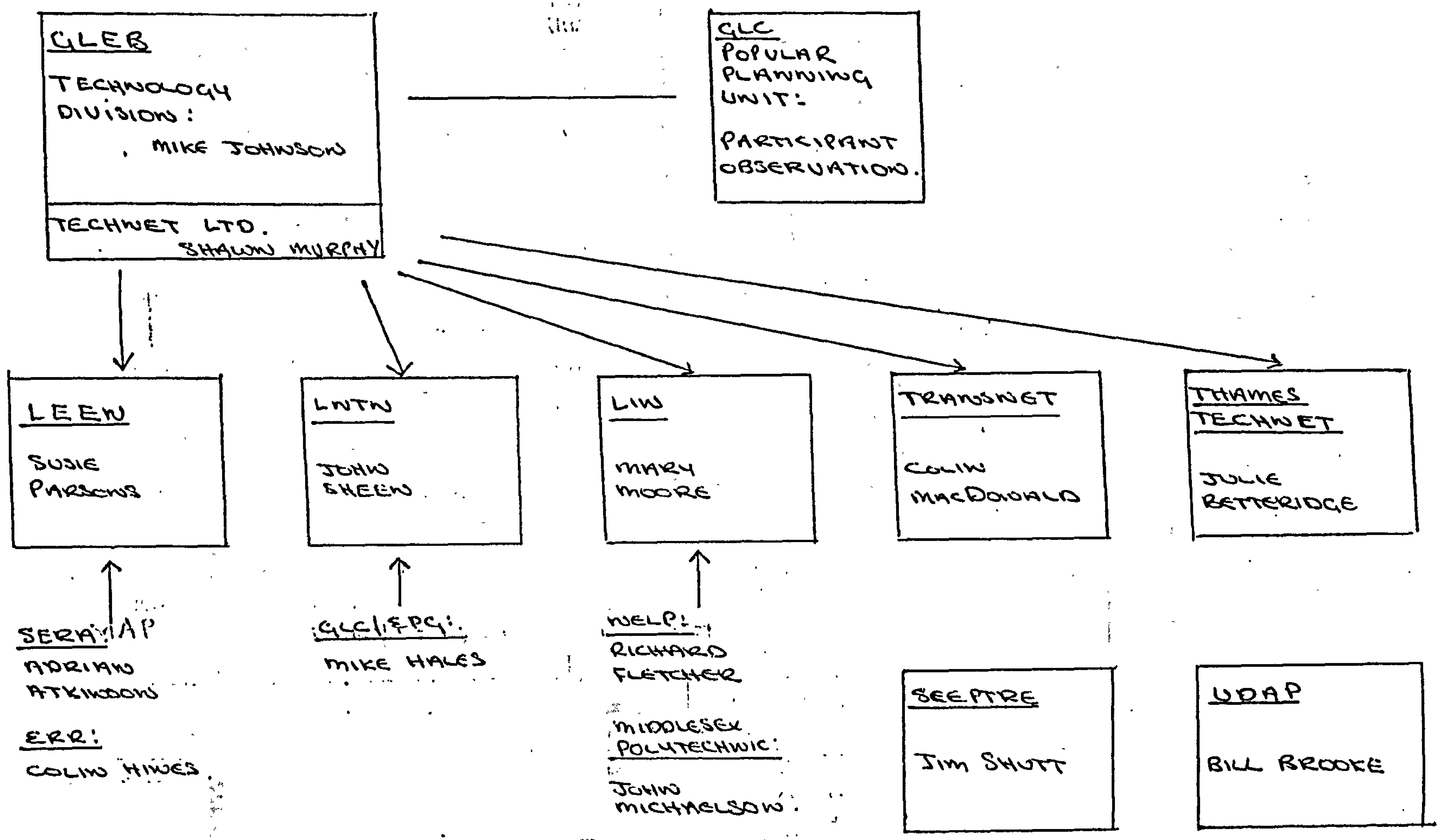
g) what was the nature of projects/products in the Network?

h) how would the product be manufactured?

i) how would the product be marketed or distributed?

j) what were the main problems encountered in the design/development of socially-useful products?

MAP OF INTERVIEW RESPONDENTS - APPENDIX TWO.



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